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Can Rate Regulation Be Simplified?

IN VIEW of the cost of rate regulation by commissions, including the economic drawbacks of long drawn out proceedings, it becomes important to consider whether such tasks can be simplified with justice to the interests concerned. As an illustration, let us take the determination of a fair rate for street lighting. A contract approaches expiration. The municipality desires to continue the use of central-station service, but cannot agree with the company upon the rates to be paid. The two parties appeal to the state commission to settle their difference, and the battle is on. Parenthetically, we may remark, service is continued at an agreed schedule of rates subject to a retroactive adjustment to conform to the finding of the regulating tribunal, and this insures the public against the interruption of one of its most important facilities.

With the mobilization of municipal and company resources on opposite sides of the table, in a representative case the commission will be asked to grant a particular rate schedule based upon an estimate of what the grand total cost of street lighting per lamp per year is thought to be. The company may present one estimate and the city another; or possibly the municipality may content itself with trying to scale down the company's claimed costs at every possible point. The complications which arise from the painstaking efforts of engineering experts, company executives, legal luminaries and municipal officials and their advisers to convince the commission that the yearly cost of service per lamp is this or that total sum are nothing short of amazing. Extended study of rate cases of this class inclines one to the opinion that at best only an approximate idea can be attained of the cost of any particular service per unit; that all attempts to run a corridor through the complex economic and operating structure of a public utility are beset with difficulties, due to the need of making assumptions at various points in the work; and that a final judgment as to the equity of a particular rate must be rendered only after the total earning power, expenses and charges carried have been carefully weighed.

This sounds as though we were skeptical about the value of trying to ascertain the approximate cost of any particular class of service, but such is not the case. We merely wish to point out that there is today a tendency to go to too great refinement in allocating such costs. Different theories of ascertaining costs have different values, of course; but we wish to make the point that a seasoned tribunal, in fixing a rate deemed by it to be fair, is sure to be influenced by more factors than the estimated cost of furnishing a particular specialized class of service at a given date, taking into account the investment estimated as in vogue on that date and a reasonable return thereon.

Going back to the street-lighting case, it is clear that the rate fixed for each class of service should properly include (with a liberal margin) all the expenses which are positively chargeable to the rendering of the particular service. Among these are the yearly operating costs of energy supply, the maintenance of individual lamps and street-lighting circuits, renewals of rectifier tubes, electrodes, globes, and other equipment exclusively devoted to street lighting. We make no pretense of listing all these items, but surely it should be feasible to set down with pretty fair accuracy the first cost and the operating cost of those parts of the street-lighting supply system which reasonable engineers will concede are certainly to be borne by the street-lighting rate. Here, on some systems, at least, one should be able to establish a base for further advance. It may be granted that on other systems the separation of street-lighting equipment between the lamp globe and the station bus involves more allocation than on others; but fundamentally commissions will allow and certainly fair-minded municipalities will concede, clearly demonstrated costs associated with street lighting with the ultimate rate structure. Is it not true that the determination of every possible indisputable street-lighting cost apart from those costs depending upon the method of allocation adopted for doubtful items, if established fundamentally, will simplify the latter problem of weighing the proportional cost claims advanced?

It is a fact that one cannot go far into the determination of a specific service without striking the snags of divergent opinion. Certainly some proportion of the generating plant, including building, coal-handling system, coal storage, boilers, feed pumps, turbines, condensers, piping, sack, etc., may properly be charged to the street-lighting investment. The demand of this service is pretty well settled, as is the cost of delivering energy at the station bus over a considerable period. The same thing, but with greater difficulties, applies to the distributing system. Now if the parties to the dispute can get together as to what is reasonable in allowing for production costs and fixed charges, a long step

will have been taken to rid a rate case of some of its most burdensome detail. The rock-bottom costs determined as suggested in the foregoing will be far below what the company, and very likley what the city, deems fair; but if a "so far so good" understanding—entente, we had almost said—can be reached, then the remaining distance to the contended rates can be traveled with less burden. Let each contestant advocate his claimed prices with all his might; let him allocate doubtful charges and expenses with all the skill possible; but let us not forget, in carrying on such cases, that the general problems of revenue and expense, of practice in one city compared with practice in another, of growth of business, improvement in load-factor and many other things which cannot for lack of space be mentioned at this time, are bound to receive consideration by an experienced commission which may balk at accepting exhaustive detailed estimates based on assumptions about which both sides may reasonably differ in opinion.

Legislation and Conservation.

"OF ALL the lands that I have visited," says Sir Rabindranath Tagore, "the United States is the only one where a person eats the inside of a slice of bread and throws away the crust". While the East Indian poet and philosopher meant this literally, the shrewd observation has a wider significance. It illustrates the practice of the nation with reference to the country's natural resources.

Not many years ago an eminent geologist estimated the waste of natural gas to be at the rate of 1,000,000,000 cubic feet daily, and probably much more. The inside of the bread was the oil in the well, which had a market value greater than the crust of gas that was permitted to escape.

Future generations have vested interests in the natural and irreplaceable resources of a country which the present generations should respect. The most important of these resources are those which are and may be used for fuel; and the national government is justified in the employment of every legitimate measure for their conservation.

Perhaps the most efficient manner in which the coal, gas and oil resources of the country may be conserved is by the passage of suitable legislation for the encouragement of the development and use of water powers. Much legislation has been enacted with reference to this subject, but most of it has been so restrictive as to discourage private capital. That the development of water powers is imperative every engineer who has thought on the subject will concede. The problem is to convince the legislator that there are only two ways in which they can be developed. These are either by private or public means. In this country the former method at present seems to have preference, while in the province of Ontario, Canada, great strides have been made within recent years with the utilization of water powers under governmental auspices.

If development is to take place under private auspices, then the legislators must, sooner or later, recognize the fact that private capital can not be forced to undertake the project without the prospect of a reasonable profit. Reasonable profit! "Ay, there's the rub." What is reasonable profit? Is compensation for the value of the plant including the intangibles of going value and water rights after a period of from twenty-five to fifty years reasonable, or should the company developing the water power be willing to surrender its title upon receiving its investment only, provided it has earned a reasonable profit during the intervening years?

The general principles which should govern the granting of the privilege to develop water powers were clearly set forth by a body of eminent engineers and scientists in a report of the Water Power Committee of the Fifth Conservation Congress. Briefly summarized, the essential principles laid down by the Water Power Committee in its report are these: The grant should be for a sufficiently long time to be financially attractive to investors; the government should reserve unto itself the right of recapture; the government should exact some compensation for the privilege; the interest of the government should be safeguarded against speculation, and some other details by which these principles are to be made effective. Sound public policy requires that at least these minimum conditions be imposed before the privilege of devloping a water power is granted.

Everything considered, it is undoubtedly preferable to have private capital develop the water powers, and legislation should speedily be enacted that will encourage such development.

Operating Factors

IN the second installment of the article on "Load, Plant and Connected-Load Factors," appearing in this issue, Mr. Terrell Croft makes a clear distinction between load-factor and plant-factor. This is a distinction often forgotten. The dependence of plant-factor upon the rating of the machinery under consideration is well exemplified. It is clearly shown that unless the method of rating is the same, two plants may apparently have the same plant-factors, while in reality they are much different.

Much of the controversy over the relative efficiency of operation of municipally owned and privately owned plants is due to the fact that, although the same terms are used, they do not connote the same relations. The loose and inexact use of technical terms usually results in confusion. Such use is the result of a lack of appreciation of a certain psychological principle, namely, that a reader interprets, or mentally assimilates, the printed words by means of, or in harmony with, his knowledge and experience, and not in accordance with the mental content of the writer. Evidently if the technical term does not mean the same to the reader as to the writer, a wrong impression is conveyed and erroneous conclusions are drawn. The value of Mr. Croft's article is the clear distinction that he makes between terms which are habitually used interchangeably and confused.

HAPPENINGS IN THE INDUSTRY

Minnesota Electrical Association Holds Annual Convention—Contractors and Dealers in Columbus Hosts to Central-Station Employees—Report of Wisconsin Electrical Association Convention—Awards of Museum of Safety—Utah Legislature Creates Commission—Ohio New-Business Committee Meeting—Miscellaneous News Notes

MINNESOTA ELECTRICAL ASSOCIATION HOLDS ANNUAL CONVENTION.

Tenth Annual Meeting at St. Paul Considers Important Central-Station Topics.

The tenth annual convention of the Minnesota Electrical Association was held at the St. Paul Hotel, St. Paul, Minn., March 20 to 22, with a good representation of central-station and allied interests. Vice-president W. R. Haney opened the first session by reading a letter from President Ludwig Kemper in which the latter expressed his sincere regret at being unable to be present. Secretary-treasurer F. A. Otto presented his annual report. A nominating committee was appointed as follows: R. E. Brown, of Mankato; Leonard Peterson, Thief River Falls; E. F. Strong, Waconia. A committee on resolutions, consisting of J. C. Bang, of Madison, chairman; B. N. Cowperthwait, and D. F. Fleming, was also appointed.

At the afternoon session, which was called to order by T. C. Gordon, temporary chairman, Acting-mayor McColl, of St. Paul, extended a cordial welcome to the Association on behalf of the city. A paper on "Construction, Maintenance and Inspection of Distribution Systems," prepared by S. B. Hood, of Minneapolis, was read in his absence by L. Kachel. H. W. Alexander, director of publicity of the Society for Electrical Development, gave an address on publicity campaigns and also submitted valuable data gathered from his travels in nearly all parts of the country. Special mention was made of the six weeks' campaign designated as "Wire Your Home Time," from April 1 to May 15. The subject of electric cooking was presented in a paper read by E. H. Adler, which elicited an exhaustive discussion. A motion picture entitled, "Romance of the Old Style School," was shown; this was kindly furnished by the Westinghouse Electric & Manufacturing Company.

At other sessions, papers were presented as follows: "Twenty-Four-Hour Service in Towns of 1,500 Inhabitants and Less," by Earle D. Jackson, of St. Paul; "Lighting—a By-product or a Buy-product," by W. A. Durgin, of Chicago. This was an illustrated lecture and demonstration which made a most profound impression upon all present.

Other papers presented were "Effect of Load-Factor on Operating Cost, with Special Consideration of Desirable Customers and City Pumping," by E. T. Street, of St. Paul; "How Central Stations are Making More Use of Technical Schools," by Prof. Geo. D. Shepardson; "Principles of Rate-Making," by Prof. W. T. Ryan. Numerous exhibits were made by electrical jobbers and manufacturers.

CONTRACTORS AND DEALERS MEET IN COLUMBUS.

Local Central-Station Employees Are Guests at First Annual Meeting and Banquet.

The members of the new-business department of the Columbus Railway, Power & Light Company, Columbus, O., were entertained on the night of March 14, 1917, at a banquet and theater party given by the Columbus Electrical Contractors' and Dealers' Association. In addition to the 26 representatives of the company, there were 85 contractors and dealers present.

This association was formed in March, 1916, for the purpose of co-operating to the fullest extent possible in the electrical industry in the city of Columbus. During that period the Columbus Railway, Power & Light Company alone has taken 829 contracts for the wiring of already-built houses. This work is all turned over to the contractors under a plan whereby the company pays the contractors in full at the completion of the work and allows the new customer to pay the amount in 10 monthly payments with his light bill. The contractors have wired over 400 already-built houses. During this period much progress has also been made in other branches of the industry as indicated by the improvement made in show-window lighting, the thousands of electrical appliances sold.

This meeting was unique in the fact that the Contractors Association acted as host. A fine spirit of co-operation is in evidence between the Association and the central station and both sides have pledged their loyal support to the advancement of the electrical industry in Columbus and vicinity.

Harold W. Clapp, general superintendent of the Columbus Railway, Power & Light Company, made a short talk at the banquet. He referred to the new power station now under construction, located eight miles southeast of the city. The initial installation will consist of a 15,000-kilowatt turbine unit with all necessary auxiliaries. This turbine will be placed in operation in the fall of this year.

O. L. Bowers is president of the Contractors' and Dealers' Association and Howard Thompson is secretary. C. A. Entrekin, prominent contractor of the city, made a most successful toastmaster for the evening.

LOUISVILLE RECEIVES CONSIDERATION AS SITE FOR NITRATE PLANT.

Water-Power Possibilities and Service of Local Central Station Advanced as Reasons for Government Favor.

Possibilities of the Falls of the Ohio River as a source of power were gone into in detail by representatives of the Louisville Industrial Foundation which presented to the Federal Nitrate Plant Board the claims of Louisville for its selection as the site. The river was recommended earnestly to the board as an entirely practicable source of power which could be depended on for ten months out of the year, while the Louisville Gas & Electric Company was in position to supply the plant with its supplementary requirements during such periods as the river flow would not maintain the rate required for power production. By utilizing the dam at the head of the falls now in service, hydroelectric power of 50,000 to 75,000 horsepower could be produced with an outlay of $2,000,000, while if the dam were to be raised six feet 100,000 horsepower could be developed with an outlay estimated at $5,500,000. Louis S. Streng, chief engineer for the Louisville Gas & Electric Company; Maj. George R. Spalding, United States Engineer at Louisville; C. Lee Cook, and others well versed as to the situation, discussed the hydroelectrical possibilities in connection with presentation of Louisville's claims.

ANNUAL CONVENTION OF WISCONSIN ELECTRICAL ASSOCIATION.

Fair Rate of Return, Transmission Problems and Electric Cooking Among Important Topics Discussed.

Fair returns for interests and profits in the public utility field; high-tension transmission problems; and electric service for domestic cooking were among the important topics discussed at the ninth annual convention of the Wisconsin Electrical Association held at the Hotel Pfister, Milwaukee, Wis., March 14 and 15. Halford Erickson, former member of the Railroad Commission of Wisconsin, discussed the subject of fair returns in a forcible manner, pointing out that the investor, whom the utility must depend upon for additional capital, must be able to see that the plant has net earnings which altogether amount to not less than eight per cent on the face value of the plant, its activities and business. Mr. Erickson discussed at some length the theory of financing for public utilities and showed that extensions and improvements are continually necessary and must be made regardless of money conditions, while other industries can arrange their financing problems so as to secure money at the most favorable rates.

R. B. Brown, of Milwaukee, discussed Mr. Erickson's address briefly, calling attention to the conditions under which capital must now be obtained. Unlike other industries public utilities must have surplus earnings to provide against any contingency and investors must know the earnings of the past, the present and of the future.

The report of the Committee on Associations was presented by B. F. Lyons, of Beloit, and dealt with the advantages of affiliation with the National Electric Light Association, as a geographic section. As referred to in our last issue, the matter was referred to the executive committee of the Wisconsin Electrical Association with power to act, the sense of the meeting being that it would be desirable to affiliate.

A. C. Babson, chairman of the Committee on Rural Service, presented a statistical report which was compiled from a canvass made among the utilities of Wisconsin. The report indicated that there has been an increase of 54 per cent in the number of companies supplying rural service, while during the past year there has been an increase of 120 per cent in the number of rural customers. It was reported that the most general practice is to require the farmer to pay for the cost of transformer installation and secondary system, although in some cases utilities require farmers along a proposed line to pay for the entire cost. Single-phase service seems to predominate and in only a few cases are single-phase motors over five horsepower in use.

The discussion indicated that while practically all companies were supplying some rural service and considered this an important field for future development, the construction of purely rural lines under present market conditions was hardly profitable. Some experience with iron wire for farmers' lines were recounted, it being the consensus of opinion that the much lower cost of this class of construction made it desirable to further investigate the comparative merits of iron and copper lines.

A. E. Peirce reported that an analysis made by the Wisconsin-Minnesota Light & Power Company indicated a difference in cost of $22,000 in favor of iron wire for a 28-mile line which the company is planning. Iron wire will probably be used he said.

Transmission Problems.

A very interesting paper by C. W. McIver, Jr., of the Wisconsin-Minnesota Light & Power Company, was presented on March 15 by A. E. Peirce in the absence of the author. This paper dealt with lines for the distribution of power to small communities through intermediate distances and voltages and was based on the experience of the Wisconsin-Minnesota Light & Power Company in constructing a number of lines of this character. Mr. McIver pointed out that the small community is being considered more and more in the sale of electrical energy and it naturally evolves upon the engineer to strike that balance between fair cost and good service to the consumer, which will make it possible for the inhabitants of small towns to enjoy the advantages of electric service, and at the same time return a fair profit on the investment to the stockholders of the utility company.

The yearly earnings of the sale of electrical energy in a town can be roughly divided as regards their disposition into three parts, namely, interest and investment, depreciation of property and operation costs.

The first two mentioned need no further elaboration. A fair allowance of six per cent for each or 12 per cent of the original investment, must be taken out of the yearly earnings of the town to pay these charges of the money invested. The third item is not a fixed charge in quantity, nor in ratio, to the amount of the investment. It has been the experience of Mr. McIver that the operation cost of a small town invariably depends largely upon local conditions. The overhead charges are generally the determining factor. When it is possible to care for the operation of a small town from the district office, the operation expense can be kept down to eight to 15 per cent of the earnings, but in the case of isolated small towns receiving power from a high-tension line, it is usually necessary to have a local manager and office, consequently the operation may rise to anywhere from 15 to 25 per cent of the earnings. Of course, the proportion of the local operation can be naturally decreased from any single town by putting one manager in charge of several small places, where this is feasible, but even then the percentage cannot be computed at less than 20 per cent and the engineer still be within a fair margin of safety on his estimate.

To make these statements more concrete some actual cases were cited. The Wisconsin-Minnesota Company has several small towns, A-B-C-D-E-F-G-H-I-J being supplied with power from transmission lines, at voltages ranging from 6,600 to 66,000, single and three phase, with connected loads from 16 to 140 kilowatts.

The following is a summary of the results for 1916:

	Population	Connected Loads	Kilowatt-Hours per annum	Kilowatt-Hours per capita	Operating Exp.	Earnings	Per cent of operation to earnings	Substation capacity, kilowatts	Total cost	Cost per kilowatt	Cost Per Capita
A.	417	28	12,226	30	$230.00	$1,549.00	14.8	.....	.....	.....	$7.55
B.	425	20	7,864	20	145.00	940.00	15.5	.....	.....	.....	9.28
C.	678	58	45,502	68	423.00	3,674.00	11.5	100	$3,898.00	$38.98	7.05
D.	1,474	....	112,800	77	378.00	2,528.00	15.	100	3,573.00	35.73	.....
E.	523	43	19,090	36	259.00	2,331.00	11.2	100	2,533.00	25.33	8.52
F.	700	127	64,641	92	2,194.00	4,738.00	45.8	100	779.00	7.79	.....
G.	1,000	136	93,821	92	1,784.00	6,928.00	65.8	.....	742.00	.....	.....
H.	250	16	3,546	12	9.00	462.00	1.95	50	2,431.00	48.65	22.00
I.	527	56	32,958	63	529.00	3,170.00	16.7	100	1,784.00	17.50	8.30
J.	765	140	72,768	95	328.00	1,481.00	22.2	100	750.00	7.85	.....
Avg.	675	70	47,521	58	$727.00	$2,785.00	22%	100	$1,649.00	$26.00	$10.60

The average cost per kilowatt of substations for small communities is 33,000-volt, $33.36; 13,200-volt, $17.50; 6,600-volt, $16.00.

Cost per mile of transmission lines to small communities

has been found to average $13.34 for 33,000-volt lines; $10.82 for 13,200-volt lines and $10.20 for 6,600-volt lines, all using No. 6 copper.

The voltage of these short lines is roughly established as 100 volts per mile of line, and it has been found to work out quite well. In the case of single-phase lines the regulation has been allowed to be as much as 20 per cent on the theory that this amount would soon be brought to the general standard of 10 per cent when the third wire was put on the line. In none of the present lines supplying power to small communities has it been deemed profitable to put in a three-phase system, although the equipment has already been ordered for the installation of the third wire on one of the company's low-voltage lines because of the increased demand by new business.

The substation equipment for this type of line has not been entirely standardized as yet. However, experience is teaching that good switches and adequate protection from lightning are two salient features which are quite liable to be overlooked in the small substation. The air-break switch with remote mechanical control seems to be meeting the requirements as to operation and cost most satisfactorily at present. It was reported that several pole-top oil circuit-breakers have been burned up, hence have practically been abandoned for outdoor intermediate voltage substations. The lightning arresters used are of various types. The multigap arrester with arcing horns is in quite general use on the 6,600-volt lines, and on some of the 13,200-volt lines. However, in the future electrolytic aluminum-cell arresters will undoubtedly be used on all circuits of 13,200 volts and above. The transformer capacity at these small substations has been arbitrarily fixed at a minimum of 50 kilovolt-amperes. In other cases the size of the transformer is fixed at 125 to 150 per cent of the initial load for the station.

The averages shown in the table are materially affected by the two cases where the company sells to a local distributing company Operating expenses in both of these cases being very high in comparison to the earnings. It was stated in conclusion that within reasonable transmission distance it is profitable for a power company to serve small communities by transmission lines under ordinary market conditions and such service can be given to the consumer at rates which compare very favorably with the rates in much larger towns.

In the discussion it was pointed out that in extending lines to small communities street-lighting business comprised the largest load available. It is therefore desirable to induce the community to install the maximum number of lighting units and at the most favorable rate to the utility, as it is seldom possible to increase rates after a line has been built and service is being furnished. In this connection one company reported that it insists upon a certain revenue per capita for street lighting based on an all-night every-night schedule before service is furnished. In the small communities where it is not advisable to maintain a district manager some utilities reported that satisfactory arrangements were made with local banks to collect bills and with a local drug store or hardware store to handle appliances. In this manner the cost of operation is reduced to a minimum. There was considerable discussion relative to transformer core loss in tapping high-tension lines for rural customers, the usual practice being to meter the energy of the primary side.

Electric Service for Domestic Cooking.

R. B. Snyder, sales manager of the Milwaukee Electric Railway & Light Company, presented a very comprehensive paper on electric cooking at the last session on Thursday afternoon. Mr. Snyder's paper, which will be referred to more extensively in another issue, dealt very largely with the experiences in Milwaukee.

In discussing Mr. Snyder's paper, Mr. Douglas, of Milwaukee, thought that the central-station industry was too optimistic regarding electric-cooking business, as he thought that the load-factor, because of an extensive electric cooking load, would not be improved to an extent that would justify the low rates necessary to secure the business. He maintained that the peak of the cooking load would in a majority of instances overlap the lighting peak.

G. Kuehlthan, of West Bend, stated that from 4 to 5 per cent of the total load at West Bend comprises electric cooking. No difficulty has been encountered in regard to peak conditions. The company maintains a flat rate of three cents per kilowatt-hour for electric cooking.

In regard to the question of overlapping peak, Mr. Snyder thought that the day-light saving plan, which is being advocated quite extensively, will ultimately be universally adopted and will have some effect in changing peak conditions so that electric cooking will be more profitable.

G. W. Van Derzee, of Milwaukee, pointed out that contrary to a somewhat popular belief, customers in very moderate circumstances are the ones most easily influenced to adopt electric cooking because of the labor saving and economic advantages. He cited the fact that the peak of the gas load at Kenosha, Wis., and Watertown, Wis., occurs at noon and it is reasonable to assume that electric cooking conditions would be the same. He stated that in Milwaukee a diversity-factor of 10 is expected for electric cooking.

Preceding the paper by Mr. Snyder, H. W. Alexander, of the Society for Electrical Development, delivered an address outlining the constructive work which is being done to increase the commercial efficiency of the electrical industry, particularly central stations, and to the literature which the Society has published in this connection. Special reference was made to the forthcoming Wire-Your-Home-Time campaign and the various features of the prize contest were outlined.

Election of Officers.

The annual banquet of the Association, which was held in conjunction with the Wisconsin Gas Association, took place on Wednesday evening in the Fern Room of the Hotel Pfister. J. Adam Bede was the principal speaker. The election of officers, which took place at the last session, resulted as follows:

President, B. F. Lyons, vice-president and general manager, Beloit Water, Gas & Electric Company.

First vice-president, A. E. Peirce, vice-president, Wisconsin-Minnesota Light & Power Company, Eau Claire, Wis.

Second vice-president, John St. John, secretary-treasurer, Madison Gas & Electric Company.

Third vice-president, F. C. Ludden, Mineral Point Public Service Company.

Secretary-treasurer, George Allison, Milwaukee, Wis.

AMERICAN MUSEUM OF SAFETY AWARDS MEDALS.

The Connecticut Company Receives Railway Prize—Other Awards to Industrial Companies.

President Arthur Williams, of the American Museum of Safety, has made public the contents of the report of the Jury of Award covering the award of four of the five gold medals which are given annually by the American Museum of Safety for noteworthy achievement in the realm of safety. The Jury has not yet completed its deliberations relative to the award of the E. H. Harriman memorial medals, which are given annually to the American steam railroad which during the past year has been the most successful in protecting the lives and health of its employees and of the public. The awards for 1916 are as follows:

The Anthony N. Brady Memorial Medal, awarded to that electric railway company, which for the year of the award has done the most to conserve the safety and health of the public and of its own employees, is awarded to the Connecticut Company, with headquarters at New Haven, Conn., and of which L. S. Storrs is president. The work of this company impressed the jury as of great value in the safety movement, not only for the excellent record made as far as electricity is concerned, but also on account of the efforts made to enlist the co-operation of the public. The company operates its line in more than a dozen cities, including Bridgeport, New Haven, Waterbury, and Hartford, where operating conditions have been rendered more difficult due to the influx of population along the lines, resulting from the expansion in manufacturing occasioned by the war. Honorable mention goes to the Pacific Electric Railways of Los Angeles, Cal., and the Interstate Public Service Company of Indianapolis, Ind.

The Scientific American Medal awarded for the most efficient safety device invented within a certain number of years, and exhibited at the Museum, is awarded to the Pullman Company, for originating the "Dean" end frame for passenger cars.

The Louis Livingston Seaman Medal, awarded for progress and achievement in the promotion of hygiene and the mitigation of occupational diseases, is awarded to the Julius King Optical Company of New York City, as a recognition of its scientific investigation of the effect of colored lenses worn by workmen whose eyes are exposed to the blinding glare of metal melting and refining operations, oxy-acetylene welding and electric arc welding. An effective color has been devised for lenses which will completely interrupt the ultra-violet and infra-red rays of the spectrum and allow only the most valuable rays of the natural spectrum to pass, thus giving the workman the maximum of illumination, and complete protection against retinal irritation.

The Travelers Insurance Company's Medal, awarded to the American employer who has achieved greatly in protecting the lives and limbs of workers, is awarded to the Commonwealth Steel Company of St. Louis, Mo., for its splendid safety system, and protective devices, the sanitary methods applied throughout the plant, and for the fellowship work among its employees.

UTAH LEGISLATURE ENACTS PUBLIC UTILITIES LAW AND CREATES UTILITIES COMMISSION.

Broad Powers of Regulation of Public Utilities Invested in a Commission of Three Members.

The Utah Legislature has enacted a Public Utilities Law and it has been approved by Governor Bamberger. A Public Utilities Commission is created and it has been given jurisdiction over the steam and electric railways, all common carriers, express companies, lighting, power and gas companies, heating companies, telephone and telegraph companies, water corporations (including irrigation companies) and warehousemen. A salary of $4,000 is provided for each of the three commissioners. A strong attempt was made by some of the members of the Legislature to have included within the jurisdiction of the Commission coal companies, sugar companies, lumber companies and other lines of trade which may be found by the Commission to have a virtual monopoly of the business in the state, but this provision was finally defeated.

Filing and Fixing of Rates.—All of the utilities affected are required to file with the Commission their schedules of charges and no utility is permitted to change its charges without first receiving permission of the Commission to do so. The Commission may fix schedules of rates for the various utilities and may modify any requirements, orders, rules, or regulations, if such a change is desirable.

Discrimination Prohibited.—Discrimination in rates, service, or facilities, is prohibited as between localities or as between classes of service. Sliding scales of charges, however, are permitted, providing such schedules are not found to be discriminatory. All forms of rebates are prohibited. All free passes and reduced rates are prohibited, except to officers, agents, and employees of the utilities, ministers of religion, and persons engaged in special occupations which are commonly excepted in anti-pass legislation. The Commission may require fixing of through routes and joint rates for railways and the interconnection of telephone and telegraph lines and such other utilities as it may find advantageous to the public welfare. Common carriers, telephone and telegraph companies are prohibited from making a greater charge for transportation of persons or property or transmission of messages for shorter than for a longer distance over the same route. The Commission is given authority to relieve the utilities of the requirements of this section, if it believes it is in the interest of good public policy to do so.

General Powers of Regulation.—The utilities are required to furnish the Commission with such information, including maps, contracts, etc., as it may desire. Such information may be withheld from the public except that which is specifically required by the act to be open to public inspection, such as schedules of rates, rules, regulations, etc. The utilities are required to furnish an annual report in such form as the Commission may require, covering their operation during the year.

The Commission may make any investigation on its own volition which it may believe in the interest of the public and may institute such hearings upon due notice covering any matters which it wishes to investigate. Whenever the Commission shall find after hearing that the rules, regulations, appliances, facilities, or service of any public utility or its method of manufacture or distribution are unjust, unsafe, or inadequate, it may determine what are the proper conditions and require the utility to provide them. It may order such extensions, repairs, or improvements as it may find are reasonably necessary to the public welfare. It may require the utilities to operate their systems in such a manner as to promote and safeguard the health of their employees and patrons, including the installation and maintenance of proper safety appliances. The Commission is required to investigate the cause of all accidents on the property of all public utilities and may require such changes as in its judgment are necessary, after the investigation, to prevent a recurrence. All utilities are required to file a report of all accidents.

Standards of Service.—The Commission is authorized to fix just and reasonable standards for the service to be furnished and for the measurement of the quantity and quality and other conditions pertaining to the supply of the commodity or service furnished and it is given authority to enter the premises of the public utilities for the purposes of making such tests as are necessary to determine whether or not service is being furnished in accordance with the requirements. Consumers may have tested their meters or other instruments for measuring the service supplied upon payment of fees to be fixed, but the utility is required to pay for the cost of the test if the meter or appliance is found to be incorrect to the disadvantage of the consumer.

Valuation.—The Commission is given authority to ascertain the value of the property of every public utility and to make revaluations from time to time of new construction, extensions, and additions to property. It may also fix a standard system of accounts to be kept by the public utilities subject to its jurisdiction and the utilities are prohibited from keeping any other system of accounts thereafter. The Commission may require the establishment of adequate depreciation accounts.

Certificates of Convenience and Necessity.—No utility is

permitted to begin the construction or operation of any new system or extensions to its present system without having first obtained from the Commission a certificate that the present or future public convenience and necessity requires such construction and the Commission may after hearing issue or refuse to issue such permit. Wherever a franchise is necessary in order to begin new construction work, the Commission may issue a preliminary certificate declaring that it will issue the desired certificate for new construction work after the franchise has been secured from the proper public body. When ordered to do so by the Commission, the utility is required before entering into any contract for construction work or for the purchase of new facilities to submit such proposed contract to the Commission for its approval and, if the Commission finds that such proposed contract and purchase may directly or indirectly divert the funds of such utility to any of the officers or stockholders of any corporation in which they are interested or if the contract is not for the economical benefit of the utility, then the commission shall withhold its approval and may order such other contracts or purchases as it may find to be legitimate.

Appeals from Commission to Courts.—The Commission may not be bound by the technical rules of evidence in the conduct of its hearings. It may issue subpoenas, writs of attachment and such other processes as are necessary to accomplish the powers granted it by the act. Provision is made for the appeal from the decision of the Commission to the Supreme Court of the State for the purpose of having the lawfulness of any decision inquired into and determined. No new or additional evidence may be introduced in the Supreme Court, but the case shall be heard on the record of the Commission as certified to by it and the review of the Supreme Court shall not be extended further than to determine whether the Commission has regularly pursued its authority, including the determination of whether the action under review violates any of the constitutional rights of the petitioner.

Prosecution and Penalties for Violation of Act.—When complaint has been made to the Commission concerning a rate or charge for a commodity or service and the Commission finds that the public utility has charged an excessive or discriminatory amount or has discriminated against the complainant, the Commission may order that the public utility make due reparation to the complainant. The Commission is specifically charged with the duty of seeing that the provisions of the constitution and the statutes of the state affecting public utilities are enforced and obeyed and the attorney-general or the proper district or county attorneys must assist in any investigation, hearing, or trial, under the provisions of the act when called upon to do so. Whenever the Commission is of the opinion that any public utility is doing or is about to do anything which is in violation of the provision of the act or the state constitution, or laws, it is directed to start action in the proper court to restrain the utility until such time as a hearing can be had on the facts. Any public utility which violates any of the provisions of the state constitution, or laws, or fails to comply with any order of the Commission, unless the penalty has otherwise been provided for in the act, is subject to a penalty of not less than $500 nor more than $2,000 for each offense. Any employee or agent of a public utility who fails to comply with any of the provisions of the act or orders of the Commission, either directly or indirectly, is guilty of a misdemeanor and is punishable by a fine not to exceed $1,000, or by imprisonment not to exceed one year, or by both. Provision is made that, if any portion of the Public Utilities Act is held to be unconstitutional, this decision shall not affect the validity of the remaining portions of the act.

An appropriation of $50,000 is made to provide for the expenses of the Commission for the coming bi-ennium.

MEETING OF OHIO NEW-BUSINESS COMMITTEE.

Financing Motor Installations, Free Service, Raw-Water Ice-Making and Commercial Rates Among Important Subjects Discussed.

The third convention of the Committee on New Business Co-operation of the Ohio Electric Light Association was held at the Hotel Miami in Dayton on Wednesday, March 14, 1917, and was attended by approximately 100 representatives of the commercial departments of the various electric light and power companies in Ohio, and also by well known commercial men from New York, Chicago and Indianapolis.

The meeting was called to order shortly after 10 o'clock by J. E. North, commercial manager of the Springfield Light, Heat & Power Company, Springfield, O., and chairman of the committee, who introduced Judge E. P. Matthews, vice-president of the Dayton (O.) Power & Light Company.

Judge Matthews in his address of welcome dwelt on the great need of educating the people to the full meaning of electric service, indicating that live central-station companies were not only selling electricity at the present time, but electric service.

The first paper presented was that of "Financing Motor Installations," by F. I. Woltz, power engineer, Union Gas & Electric Company, Cincinnati, O. This paper is referred to elsewhere in this issue. The discussion was opened by F. B. Steele, power engineer of the Dayton Power & Light Company, who favored trial motor installations, and presented statistics on the plan used by several eastern companies. H. B. Craft, of the Columbus Railway, Power & Light Company, was not in favor of financing motor installations, especially in large cities, referring to the effect on other prospective power customers if the business is not secured on a regular contract, after making a trial installation.

R. A. MacGregor, the sales manager of the Merchants Heat & Light Company, of Indianapolis, Ind., stated that it was his belief that in some instances the financing of motor installations was good business, but he rather favored the prospective power customer being taken to power installations similar to his own, and being "sold" in that manner. This paper was also discussed by Mr. White of the Cleveland Electric Illuminating Company, Cleveland, O., and John G. Learned, of the Public Service Company of Northern Illinois, Chicago, and Chairman J. E. North.

O. A. Achuff, new-business manager, Massillon Electric & Gas Company, Massillon, O., in presenting the subject, "Free Service," laid great stress on free service that is supplied through the officers of a central-station company, being active in civic affairs of the city through such organizations as the Chamber of Commerce, etc., and referred to the benefits that his company had received as a result of such co-operation.

In discussing this paper O. B. Reemelin, general superintendent of the Dayton Power & Light Company, referred to the very liberal free service plan in Dayton, the maintenance man being instructed to call on customers and make quick repairs to irons, fans and various appliances, charging them only with the material used at the net cost and donating the labor. C. E. Yacoll, of the Mahoning & Shenango Railway & Light Company, Youngstown, O., did not believe that the customer was entitled to any free service. This paper was also discussed by J. M. Stone, of Mansfield, O., and E. Kelsey, of the Toledo Railways & Light Company, Toledo, O. The latter in his discussion referred to the fact that the Doherty organization now has a man who makes a business of visiting the various towns and cities and co-operates with the civic business organiza-

tions in bringing new industries to the various cities in which the Doherty companies are operating.

The convention recessed at 12 o'clock for luncheon, which was held in the breakfast room of the Hotel Miami, and immediately following the luncheon were entertained by a most interesting talk on "Salesmanship" by A. F. Siebert of Dayton, O.

The afternoon session was opened by the presentation of a paper entitled "The Manufacture of Raw-Water Ice," which had been prepared by A. M. Heritage, the refrigerating engineer of the Triumph Ice Machine Company, Cincinnati, O., but in his absence was presented by R. Hayes of the same company. Mr. Hayes dwelt at some length on the desire of his company to co-operate with the representatives of central stations to secure refrigerating and ice-making business. Mr. Hayes stated that from 48 to 70 kilowatt-hours were required to manufacture a ton of raw-water ice, adding that a manufacturer of ice should feel very well satisfied when his power is costing from 60 cents to 65 cents per ton, manufactured. This paper was discussed by C. E. Yacoll, of the Mahoning & Shenango Railway & Light Company, Youngstown, O., and J. C. Matthieu, power engineer of the Dayton Power & Light Company.

The next subject to be discussed was that of "Commercial Rates" by T. E. Hollingsworth, commercial manager, Ohio Light & Power Company, Newark, O. This paper was discussed at some length by M. B. Buckley, power engineer of the Henry L. Doherty Company, New York City; R. A. MacGregor, Merchants Heat & Light Company, Indianapolis, Ind.; F. H. Cooper, new-business manager, Northwestern Ohio Light Company, Van Wert, O., and H. B. Craft, of the Columbus Railway, Power & Light Company, Columbus.

Mr. Craft in his discussion stated that approximately 75 per cent of the central-station companies of Ohio have a demand rate in some form.

The last paper on the program was entitled, "Motion Pictures as an Aid to New Business," and was presented by F. H. Hooper, new-business manager, Northwestern Ohio Light Company, Van Wert, O. Mr. Hooper showed a very interesting motion-picture film which he has used in securing business.

During the afternoon session H. W. Alexander, director of publicity of the Society for Electrical Development, addressed the delegates about some of the plans of the Society to further the sales end of the industry and explained in detail the Society's plans for "Wire Your Home Time," which campaign is to take place from April 1 to May 15, 1917.

As a fitting climax to the very successful convention an immense banquet and cabaret was held that same evening in the ball room of the Hotel Miami, under the auspices of the Dayton Jovian League.

There were more than 200 Jovians and friends present on this occasion and a very interesting evening was spent.

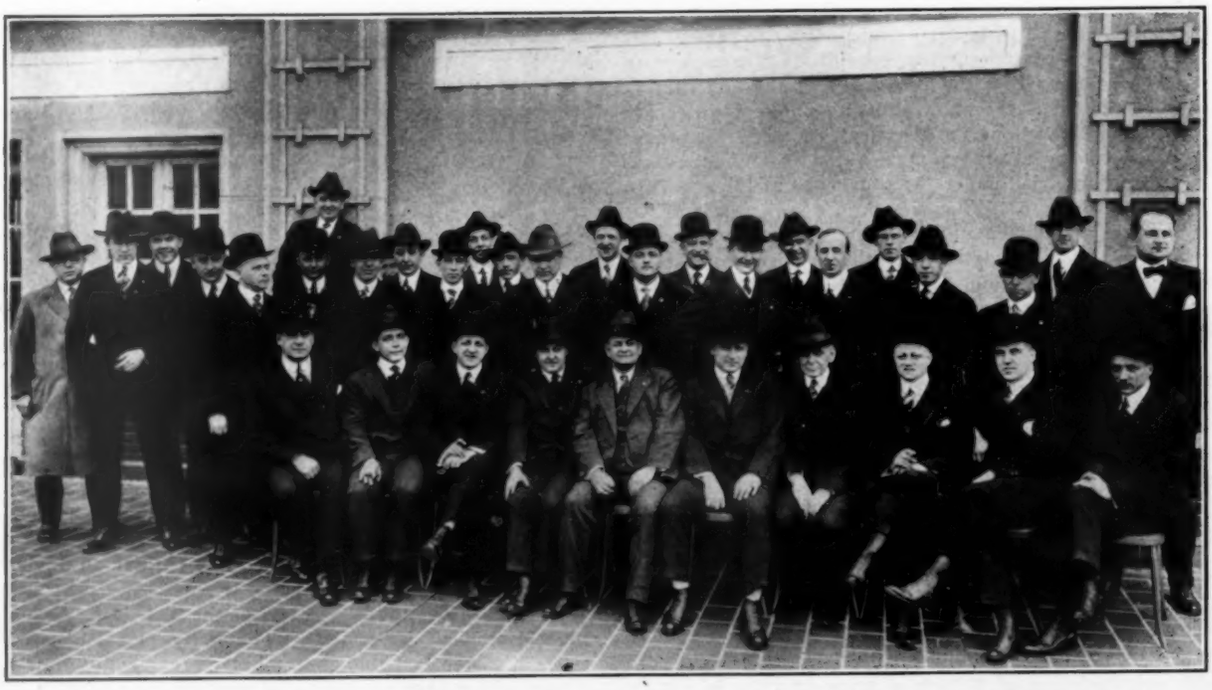
During the dinner the guests were entertained by a special cabaret show that had been brought to Dayton for the occasion.

C. S. Hall, treasurer and general manager of the William Hall Electric Company, Dayton, O., and president of the Dayton Jovian League, acted as chairman of the meeting and introduced as toastmaster D. L. Gaskill, president of the Greenville (O.) Electric Light & Power Company, and secretary of the Ohio Electric Light Association.

Mr. Gaskill in turn introduced the following speakers: H. M. Waite, city manager of Dayton; W. W. Freeman, president Union Gas & Electric Company, Cincinnati; C. F. Kettering, vice-president the Domestic Engineering Company, Dayton; F. R. Coates, president the Toledo Railways & Light Company; Judge R. W. Baggott, Court of Domestic Relations, Dayton.

New York Companies' Section, National Electric Light Association, Holds Big Meeting.

The March meeting of the New York Companies' section of the National Electric Light Association was held on the evening of March 20 with over 300 present. The principal speaker was William Leslie French. The meeting was a big success in every way. Mention was made of the intensive national membership campaign now being conducted throughout the country, a report being read from Chairman Walter Neumuller, who is now touring the West and finds conditions very favorable for a successful outcome of this campaign.



Group at Meeting of Ohio New-Business Committee of the Ohio Electric Light Association at Dayton, March 14.

SOLUTION OF AUTOMOBILE GLARE PROBLEM.

Interesting Discussion at Meeting of Chicago Section, Illuminating Engineering Society.

At the meeting of the Chicago Section of the Illuminating Engineering Society held on the evening of March 16, James R. Cravath gave a demonstration and illustrated talk on automobile headlights and the method of solving the objectionable glare usually associated with them. He stated that this problem applies just as much to the headlights of locomotives and interurban electric railways as it does to automobiles. The chief objectionable element of glare involved in this problem is the reduction in visual power, or blinding effect, because in this lies the greatest danger both to drivers and to pedestrians; discomfort and eye fatigue are not so important in this problem.

It must be noted that it is possible to reduce, but not entirely eliminate, glare of headlights. The light must not be cut down too much because this involves serious danger. On well lighted streets or roads it is not necessary to have very bright headlights, but Mr. Cravath was not in favor of the practice in vogue in some places of using sidelamps only on city streets. He felt that if the problem is solved for country roads the entire matter will be well in hand, because it is in the country that the most troublesome features are encountered. Here it is necessary to have a powerful headlight for illuminating a considerable stretch of road ahead and this should be confined not merely to a narrow beam, but to the illumination of a considerable width of the roadway. The glare of headlights is due almost entirely to the extremely high candlepower in the center of the beam, which frequently approximates 20,000 candlepower. This must be reduced.

The extremely large number of solutions of the problem that have been presented fall in general into two classes, of which the first involves dimming or diffusing the light, by using an auxiliary small lamp, by rheostatic dimming, or by using a diffusing medium. In all cases, this results in reducing the light upon the roadway as well as the high candlepower in the center of the beam. A second method consists in beam control, which must confine the high-power beam to a zone not over 36 or 42 inches above the road, the idea being to direct the brightest rays upon the roadway where they are needed for illumination and at the same time keep them from striking the eyes of pedestrians or of drivers coming in the opposite direction. Of the great multitude of devices that have been proposed and even actually tried out, Mr. Cravath felt that the first class did not at all meet the requirements. On the contrary, the second class was agreed upon by all illumination authorities that have given proper consideration to the problem as being the best solution. Mr. Cravath showed examples of and demonstrated the action of a considerable number of glare reducers employing both the first and second methods.

In the second class when the attempt is made to direct the light below the horizontal by merely tipping the lamp forward, one obtains too narrow or too short an illuminated strip ahead of the car. The scheme of putting an opaque shade over half of the headlamp so as to cut off the rays above the horizontal results in cutting off altogether too much light and is, therefore, too wasteful and ineffective. Special prismatic and combination glassware was shown, which answers both to depress the beam and to widen it. One of those shown in particular consists of a special lens which directs the upper portion of the beam into the lower part, at the same time depressing and widening the beam.

In conclusion, Mr. Cravath pointed out the need for greater accuracy in the manufacture of lamps and reflectors and in assembling the parts into the complete headlight unit. Respecting legislation on the subject, he said that most of this is entirely defective because it does not specify clearly what is objectionable glare. A standard should be specified and Mr. Cravath recommended that this be a definite maximum candlepower above the 42-inch level. To enforce such a rule would be quite simple, since it would require merely a number of inexpensively equipped test stations to which any alleged offenders could be brought before the lamp could be manipulated. The matter was discussed by O. L. Johnson, D. S. Hatch, A. J. Johnson, F. H. Bernhard and Messrs. Flannagan and Cravath.

STANDARDIZATION OF PLUGS FOR HEATING AND OTHER ELECTRICAL APPLIANCES.

Wiring Committee of Commercial Section N. E. L. A. Takes Important Action at New York Meeting.

A meeting of manufacturers of electric heating and other appliances was held at New York on March 15 by the Wiring Committee of the Commercial Section, National Electric Light Association, to consider the question of standardizing the plugs by which the various appliances are connected to the portable cord. At the meeting there were present: R. S. Hale, chairman of the Wiring Committee, 39 Boylston Street, Boston, Mass.; S. E. Doane, vice-chairman, Wiring Committee; C. A. Bates, of Bryant Electric Company; Willis H. Booth, of Hotpoint Electric Heating Company; John A. Campbell; J. C. Dallar and H. J. Mauger, General Electric Company; A. H. Fleet and E. N. Lightfoot, Cutler-Hammer Manufacturing Company; A. G. Kimball, Landers, Frary & Clark; J. H. Kliegl, Universal Electric Stage Lighting Company; Robert Kuhn, American Electric Heater Company; J. P. Mallett, Society for Electrical Development; T. A. McDowell and M. C. Morrow, Westinghouse Electric & Manufacturing Company; H. J. Morey, Pass & Seymour.

The meeting was opened by Chairman R. S. Hale, who stated that its general purpose was to begin standardization by discussion and that the National Electric Light Association would not itself take any action unless, and until, there should be substantial agreement among the manufacturers. After a general discussion it was decided to appoint two subcommittees as follows: Committee on Round Prongs, A. G. Kimball, Robert Kuhn, H. J. Mauger, E. N. Lightfoot, and a representative of the Simplex Electric Heating Company; Committee on Flat Prongs, W. H. Booth, F. Thornton and H. T. Pelouze. R. S. Hale is to be a member and secretary of both committees.

Each of these committees is to consider the subject and submit to another general meeting reports giving the arguments and experience as to why round or flat prongs will be the best design for a standard. They will also suggest the best dimensions and specifications in case either should be adopted. The reports will also include the question of guides on appliances. These committees will meet as follows: Committee on Round Prongs at 10 a. m., May 26, at the N. E. L. A. rooms in New York City; Committee on Flat Prongs at 1 p. m. May 28 for luncheon in Atlantic City, N. J., at a hotel to be decided on later.

Each member of these committees has been requested to send to Mr. Hale by May 10, if possible, a statement of reasons for his preference for round or flat prongs and suggestions as to specifications and dimensions. Mr Hale will have copies made and a summary for easy reference at the committee meetings. In addition, and since it is possible these committees may not adequately represent the manufacturers of either or both types of prongs, any other manufacturer who desires to, is requested to send a similar statement to Mr. Hale and also to notify Mr. Hale if he would like to be present at the meeting of either of these committees. Further, if any manufacturer wishes to present the claim of any other form of connection than the round or flat prong he is requested to send the same to Mr. Hale.

Miscellaneous NEWS NOTES

Law to Prohibit Discontinuance of Electric Service.—A bill is being considered by the Pennsylvania House of Assembly to prohibit the discontinuance of electric, gas or other utility service while a dispute or controversy between the company and consumer is in process of adjustment.

Public Utility Companies to Issue Bonds Without Authority.—A bill has been introduced in the New Jersey Legislature to permit public utility companies operating in the state to issue bonds and stock without application for permission to the Board of Public Utility Commissioners, provided that the proceeds from the sale of such securities are expended on property outside of the state.

American Railway Engineering Association Meets in Chicago.—The eighteenth annual convention of the American Railway Engineering Association was held in Chicago, Ill., March 20, 21 and 22. Among the topics arranged for discussion were signaling and interlocking and the report of the Committee on Electricity. An appliance exhibit was held co-incidently at the Coliseum at which many electrical manufacturers had displays.

Large Numbers of Motors Installed in Grain Elevators.—The year 1916 was marked by exceptional activity in the building of grain elevators throughout the country. This was due chiefly to the extraordinary prices prevailing for all cereal products. During the year reports show that 1,066 country elevators and 33 terminal elevators were erected, while 215 were enlarged and 212 overhauled. In this construction and rehabilitation equipment of the elevators with electric motors was a prominent feature. A total of 275 motors was installed. Reports from elevator builders and grain dealers indicate an even greater activity during 1917.

Minneapolis Jovians Have Big Electrical Night.—The Minneapolis Jovian League had a big rejuvenation and banquet at the West Hotel on the evening of March 8. Over 400 tickets were issued for the banquet; 225 members were initiated into the local Jovian League. The banquet lasted from 6:30 until midnight and was the biggest affair of its kind ever held in the Twin Cities. O. Curtis, local Tribune, and Robert Laird, master of ceremonies, arranged for the occasion and carried out every feature in excellent order. J. E. Latta, special agent of the Underwriters Laboratories, Inc., Chicago, gave a film talk for one hour on the work of the Laboratories and its relation to the electrical industry.

Toronto Electric Club Meetings.—The Electric Club of Toronto announces the following subjects for meetings in March: March 23, L. A. Dunington Grubb, garden architect, on "The City Beautiful"; March 30, L. B. Beale, British Columbia Lumber Commissioner for Western Canada, on "British Columbia Pre-eminent." Other subjects presented to the club in March were "The Win-the-War Convention," by Benjamin A. Gould, on March 2; "Fire Waste from Electric Causes," by E. P. Heaton, fire marshal, on March 9, and "Is the Climate Changing?" by Sir Frederick Stupart, on March 16.

A. I. E. E. Meeting at Schenectady.—The 331st meeting of the American Institute of Electrical Engineers will be held at Schenectady, N. Y., on April 13. The sessions will be in the rooms of the Edison Club. The general subject for discussion will be "Temperature Corrections." A paper of that title will be presented by V. M. Montsinger. Other papers to be read are as follows: "Temperature Distribution in Electrical Machinery," by B. G. Lamme; "Rational Temperature Guarantees for Large Alternating-Current Generators," by F. D. Newbury; "Internal Temperatures of Alternating-Current Generators," by Ralph Kelly, and "Electrical Machinery Tests and Specifications Based on Modern Standards," by H. M. Hobart.

Mechanical Equipment of Catskill Aqueduct Described.—The last of the lecture series given this winter before the Lynn (Mass.) Section, A. I. E. E., was an illustrated description of the mechanical equipment of the Catskill Aqueduct, by J. Howard Williams, engineer, in charge of the mechanical equipment. He showed details of construction and operation of the project, which has cost about $138,000,000. He outlined the route of the canal from Ashokan reservoir to New York City.

Maine Legislature to Consider Bill Prohibiting Sale of Electrical Energy Outside of State.—An amendatory clause to franchise extension bills offered in the Maine Legislature limits the company concerned to supplying electrical energy within the state. The export of power is prohibited. An exception has been made in the case of the Oxford Electric Company, it being pointed out that its plant might at some time be a part of an interstate corporation, and hence its activities should not be so limited.

Electrical Interests at Mississippi Centennial Exposition.—Participation of the electrical interests in the forthcoming Mississippi Centennial Exposition, to open at Gulfport, Miss., in December next, will take the form of a "plantation electrical." This "fair within a fair" has been designed by Harry Chapin Plummer, industrial agent of the Exposition, 505 Fifth Avenue, New York City, to afford opportunity for the display and demonstration of electric motive power and electrical apparatus as applied to the processing of standard products of the Gulf tier of states, such as cotton, rice, sugar, tobacco, corn and lumber, from the ground to the finished commodity. Irrigation will be an important feature of the exhibit, while a bungalow, or dwelling, to be included, will show the newest electrical devices for the home.

Transmission Company Seeks Additional Rights.—The Rhode Island Power Transmission Company, which has been seeking rights of eminent domain for its lines, now desires the additional right to transfer its property, if desired, to other corporations. Another amendment to the enabling bill provides that property of steam and electric roads are exempt from the eminent-domain right, except for purposes of crossing the same either above or below grade. It further provides that in case of disagreement between the parties, either may apply to the Public Utilities board for determination. Appeal may be had thereafter to the Supreme Court. The bill provides for a 10-year time limit to the privilege of acquisition, and specifies that the city of Providence is not included in the area in which the transmission company may take lands.

Civil Service Examination for Electrical Draftsman.—The United States Civil Service Commission will hold an examination for the position of electrical draftsman in the Navy Department, Washington, D. C., at salaries ranging from $3.52 to $6.00 per day. Candidates will not be assembled for examination and no definite time is set. Competitors will be rated entirely on the following subjects: Education and preliminary training, which will be given a weighting of 40 points; experience, which is given a weighting of 60 points in the final grade. Preference is to be given to applicants having drafting experience of a marine electrical character, such as may be acquired in the electrical department of a shipbuilding company building battleships, submarines and other naval vessels. Experience in naval drafting is not absolutely essential, however. Applicants must be United States citizens and at least 18 years old. Further particulars concerning the examination are given in circular No. 1697 which has been issued by the Commission.

Dubuque Electric Company's Plant

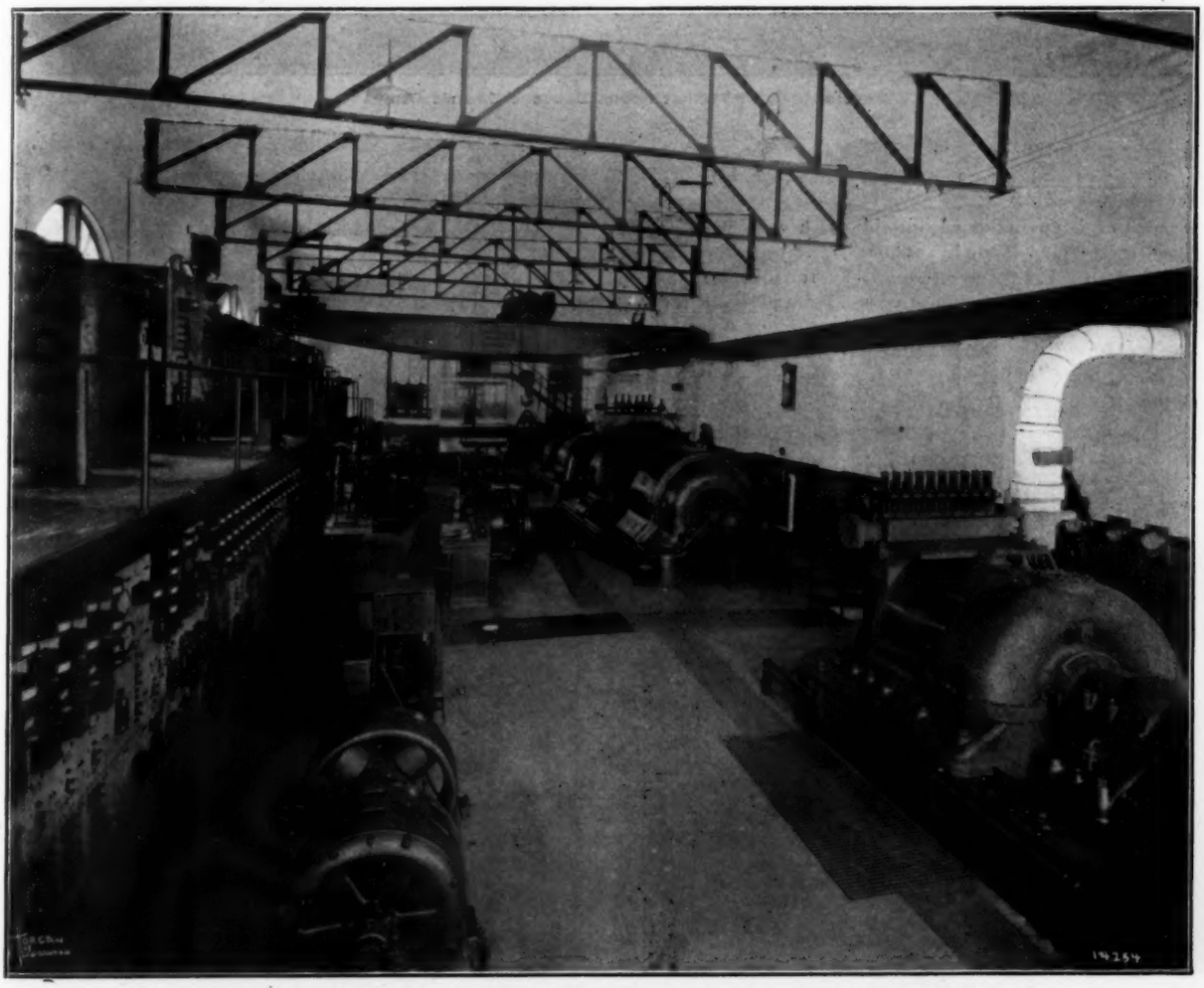
Central Power Station at Dubuque, Iowa, Was Completely Remodeled Without Interruption of Service—Special Features of This Up-To-Date Plant Which Has a Generating Capacity of 9,500 Kilowatts

By E. M. WALKER
General Manager, Dubuque Electric Company

THE improvements which were completed in the latter part of 1916 at the power station of the Dubuque Electric Company (formerly the Union Electric Company), of Dubuque, Iowa, make it one of the most modern and complete central-station plants of its size in the Middle West. This company does the entire lighting and power and street-railway business of the cities of Dubuque, Iowa, and East Dubuque, Ill., operating a bus line between the two cities, and supplies current at wholesale to another company, organized to distribute in neighboring communities. The Dubuque Electric Company was organized as a consolidation of several predecessor companies in the year 1902.

In 1903 the present station building was erected and there were installed five vertical Curtis turbines of 500 kilowatts each. At that time a steam-turbine plant was quite an innovation, and consequently the operation was watched with great interest. These small turbines were operated for the next eight years until the growth of the business, the possibilities of future demands on the plant, and the developments and improvements in prime-mover practice, caused the undertaking of plans for the complete refurnishing of the station with more modern equipment, and the work then begun was completed only a few months ago.

In 1911 a horizontal Curtis turbine was installed in place of two of the vertical machines. In 1913 a further addition was made by the installation of a 2,500-kilowatt horizontal Curtis turbine, and in 1914 the last two of the original turbines give place to a 5,000-kilowatt machine of the same general type as its two recent predecessors. The total installed capacity of the station now is 9,500 kilowatts, which is just twice the highest peak load of the plant during the winter just passed. Each turbine is equipped with a Worthington surface condenser, and the water for the condensers is handled by steam-turbine-driven pumps as follows: One tri-rotor pump of 10,000 gallons capacity, one bi-rotor pump of 5,000 gallons capacity, and one volute pump of 7,500 gallons capacity. These pumping units replaced engine-driven direct-connected units, and are all Worthington products. The piping for the condensers is so arranged



General View of Interior of Dubuque Electric Company's Reconstructed Power Station.

General View in Turbine Room, Dubuque Electric Company.

that any one of the pumping units will serve any one of the condensers and this provides a very flexible working arrangement.

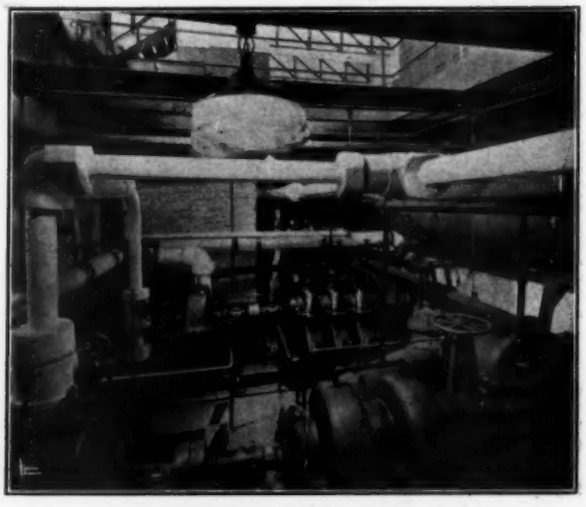
The station is an L-shaped building with principal dimensions of 190 feet 8 inches by 96 feet. The turbine room is provided with an electric crane of 25 tons capacity, this having been replaced a hand-operated crane built for 15 tons.

The street railway and direct-current power equipment consists of three 300-kilowatt rotary converters and one 750-kilowatt motor-generator set.

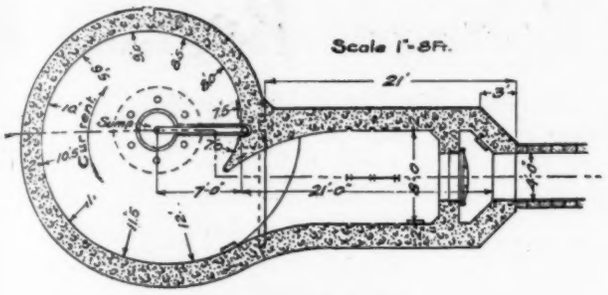
The steam-generating plant consists of three batteries of Babcock & Wilcox boilers, two boilers to each battery, the boilers being rated 400 horsepower each. Superheaters and Bayonne chain grate stokers are a part of each boiler's equipment. There is also a complete equipment for automatic coal and ash handling. Coal is received in a track hopper under the railroad track adjoining the boiler room. The last piece of apparatus to be installed is a new Cochrane metering feed-water heater, this replacing a smaller heater used since the station was built.

One of the most interesting features of the station is the intake well, which was completed early last year. The station is located on a slough of the Mississippi River, about 2,500 feet away from the main river, and therefore an abundant supply of water for the condensers presented quite

Boiler Room at Dubuque Station.



Motor-Driven Boiler-Feed Pumps.



Cross-Section of Intake.

a troublesome problem for a number of years. The new well has successfully provided a solution, however, and removed the possibility of a scarcity of water at low stages of the river, which frequently occur in midwinter and late midsummer.

Built in 1915-16, this well is designed to overcome the difficulty of low water and also, by the whirlpool action of the water in passing through the well, to remove automatically a large percentage of the sediment in the river water. The well is built on the spiral principle, the water traveling around it many times and thus allowing the sediment to settle into a sump in the center, from which it can be periodically removed by an ejector pump.

The well is 20 feet in diameter and 36 feet deep, the bottom being 6 feet below zero stage of the river. The intake pipe is 36-inch flanged cast iron. This well is capable of supplying many times the maximum demand of the plant at its present size.

Another interesting feature of the station is a commodious and well equipped machine shop which was installed during reconstruction. This is provided with all the machine tools (motor-driven) necessary to do all classes of work around the plant. The savings effected in this way over what the cost of installation of machinery would have been had the machine work been taken out to nearby machine shops more than paid for the equipment in the machine shop; and the incidental work coming up almost daily more than warrants its retention.

Southern Illinois screenings are used as fuel. The operating results obtained in plant operation have amply repaid for the care displayed throughout the period of reconstruction in installing the best obtainable machinery and apparatus—not cost but efficiency being the determining factor. All stages of the reconstruction were executed without interruption of the service. This involved some difficult problems at times, but was carried out with entire success.

Bill to Insure Prompt Action by Rate Commissions Vetoed.

Governor Capper of Kansas has vetoed a bill, passed almost unanimously by the house and senate, which would have required the Public Utilities Commission to take prompt action on rate matters submitted by utilities. Under the present practice, the commission may take such time as it wished to decide cases. The bill would have required it to decide within 30 days whether a formal hearing was necessary, and then to give its final judgment within the next ten months.

Educational System for Elementary Electricity.—The central continuation school of Milwaukee has inaugurated a course in electricity for beginners. The school is a part of the Milwaukee industrial educational system associated with the public schools.

View of Main Switchboard with Exciter Sets in Foreground, Dubuque Electric Company's Plant.

An Instantaneous Voltage Regulator

Description of the Construction and Installation of a Voltage Regulator that Permits Lighting and Power Loads to Be Supplied from the Same Transformer, Thus Improving the Economy and Efficiency of Central-Station Distribution Systems

By CHARLES J. HEJDA

AMONG the recent inventions which should prove of considerable value to central-station companies employing a large number of distribution transformers for supplying light and power, is a new compensating device known as the "Schweitzer instantaneous voltage regulator," by means of which it is possible to connect single-phase or multiphase power to the same transformers supplying lights, and maintain good regulation on the lighting service irrespective of the voltage disturbances on the transformer, due to starting of motors or voltage fluctuations caused by variations of load on motors.

The regulator is mounted on the pole alongside of the service transformer and connected in series with the low-voltage side of the transformer ahead of the light and power load. The regulator consists of two main windings having a common magnetic circuit, one winding being in series with the motor load and the other in series with the lighting load. On a three-wire lighting service the lighting coil is divided into halves and each half is connected in series with one of the outside lighting wires. Two auxiliary windings, one on the same leg with the main motor winding and the other on the leg with the main lighting winding, are employed to vary the amount of boost required to compensate for the voltage drop in the lighting transformer that is caused by starting of motors or variation of load on motors. The auxiliary windings are connected in series with each other in such a manner that their induced voltages are opposed. The variation in compensation of the regulator is obtained by varying the number of turns in the auxiliary lighting coil by means of a multipoint switch having a suitable number of steps to give the amount of regulation required. In order to reduce the impendance drop in the main lighting coil and maintain good regulation on the lights when the lighting load changes, a non-inductive variable shunt is connected across the main lighting coils. This shunt, besides reducing the impendance of the main

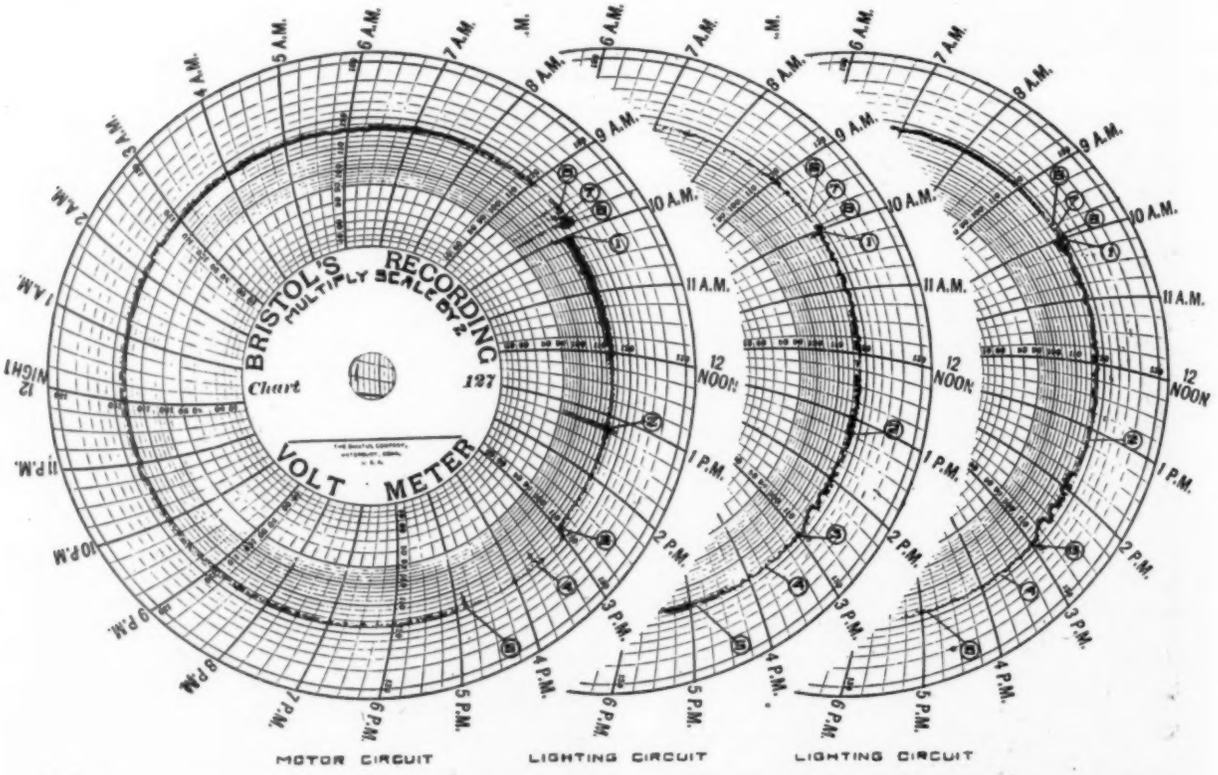

BRISTOL'S RECORDING VOLT METER
MULTIPLY SCALE BY 2
Chart
127
MOTOR CIRCUIT
LIGHTING CIRCUIT
LIGHTING CIRCUIT
KEY
(1) CHART STARTED 2-8-17 10AM, MOTOR RUNNING
(2) 3HP MOTOR MOMENTARILY STOPPED.
(3) 3HP MOTOR STOPPED.
(4) 1HP MOTOR STARTED.
(5) 1HP MOTOR STARTED.
(6) 3HP MOTOR STARTED AND RUN 3 MINUTES.
(7) 3HP MOTOR STOPPED.
(8) 3HP MOTOR STARTED AND STOPPED.
CHART REMOVED 2-17-17 10AM.
SERVICE VOLTAGES OF A LIGHTING TRANSFORMER SUPPLYING LIGHT AND POWER LOAD, SHOWING COMPENSATING ACTION OF SCHWEITZER INSTANTANEOUS VOLTAGE REGULATOR ON VOLTAGE OF LIGHTING SERVICE.

Fig. 1.—Charts Showing Service Voltage Obtained from Five-Kilowatt Transformer with Regulator.

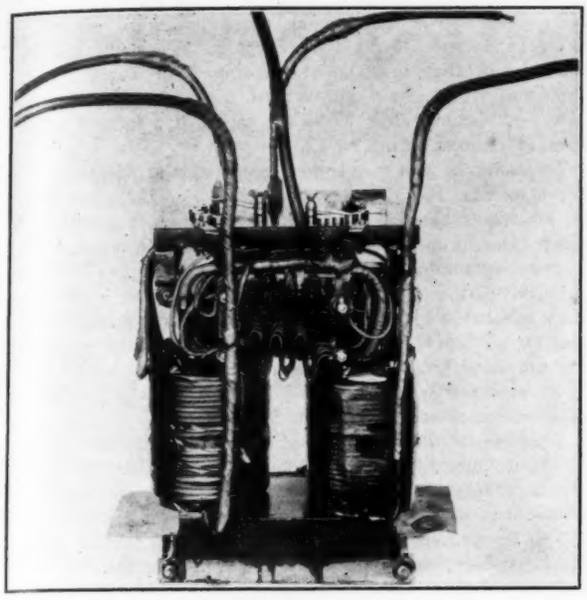


Fig. 2.—Core and Windings of Regulator.

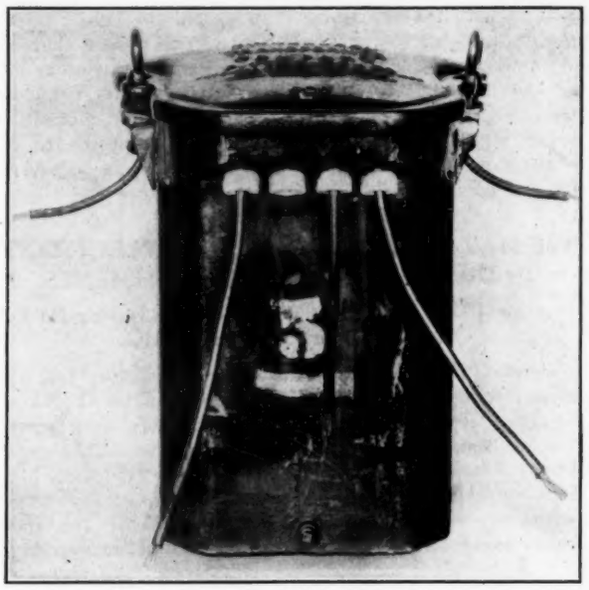


Fig. 3.—Regulator Assembled Ready for Installation.

lighting coils, also serves as an additional means for adjusting the amount of compensation of the voltage regulator.

The three charts in Fig. 1 show the service voltages obtained on the premises of a customer supplied from a five-kilowatt transformer with regulator, to which were connected a total of 310 lights, a 750-watt heater and four horsepower in motors. The left-hand chart was on the 230-volt motor circuit. The scale of this chart should be multiplied by two to obtain the correct voltage on this circuit. The two charts on the right were taken from the lighting circuit, one on each side of the three-wire service, and are direct reading. Particular attention is called to the motor chart showing the momentary voltage drop due to the starting of motors while the lighting charts show absolutely no effect of this disturbance on the transformer.

This regulator is of core-type design, oil-cooled and has the same appearance as the pole transformer. Fig. 2 shows the core and windings and Fig. 3 shows the regulator in its case. The regulator has no moving parts; therefore, when once adjusted to give correct compensation, it requires no more attention than a pole transformer. The use of the regulator enables a saving of one transformer and primary cutouts where a consumer ordinarily has separate transformers for light and power. Since the power and light can be supplied from a single transformer the load-factor on the distribution transformer is considerably improved, resulting in a higher all-day efficiency.

It is the practice among central-station companies to limit motor installations which may be connected on 115-volt service to a certain horsepower and all motors above a certain size must be connected to a 230-volt service. Likewise the instantaneous current drawn from the line by a motor when being started is limited to certain values per horsepower rating of motor. In spite of these rules, however, motors doing a certain class of work, such as those operating meat grinders, coffee mills, etc., requiring frequent starting and stopping, cause considerable voltage fluctuation on a transformer, making it very unsatisfactory for lighting load, and therefore requiring separate transformers. By the employment of the instantaneous trans-regulator it is possible to connect any size of motor to a lighting transformer regardless of the character of the motor load or motor starting current, so long as the capacity of the motor itself is within the rating of the transformer and regulator supplying the load.

The regulator can be made in any size to operate on any load and capacity of service transformer. Fig. 4 shows a schematic diagram of an installation in actual operation in

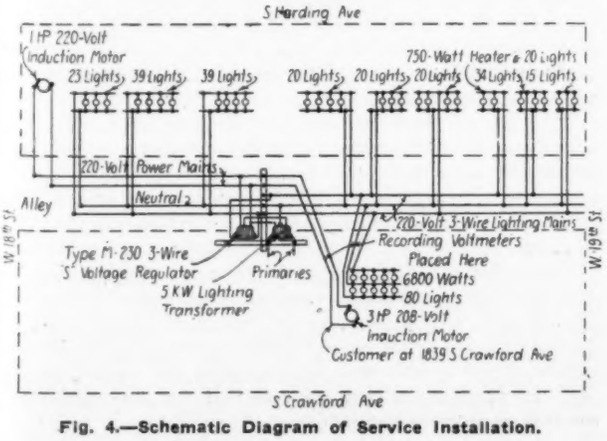


Fig. 4.—Schematic Diagram of Service Installation.

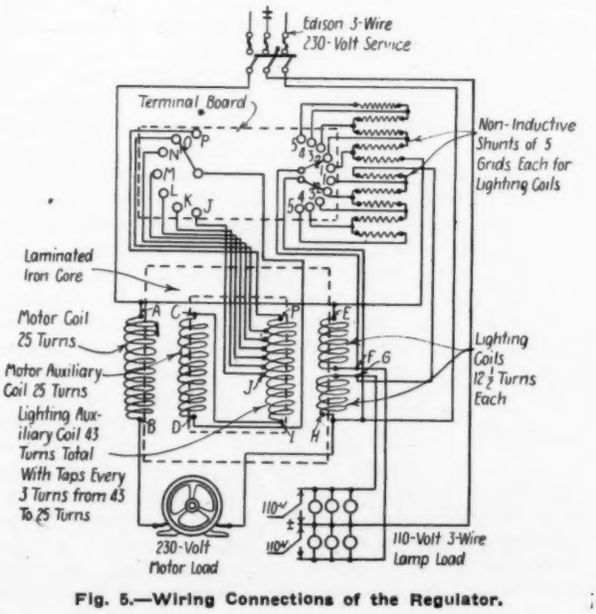

Edison 3-Wire 230-Volt Service
Terminal Board
Non-Inductive Shunts of 5 Grids Each for Lighting Coils
Laminated Iron Core
Motor Coil 25 Turns
Motor Auxiliary Coil 25 Turns
Lighting Auxiliary Coil 43 Turns Total With Taps Every 3 Turns from 43 To 25 Turns
Lighting Coils 12½ Turns Each
230-Volt Motor Load
110-Volt 3-Wire Lamp Load

Fig. 5.—Wiring Connections of the Regulator.

Chicago with the transformer and regulator layout on the pole and service to the various customers. The charts in Fig. 1 were obtained on the premises of the customer having the three-horsepower motor and 80 lights connected load. Fig. 5 gives the internal and external connections of the regulator. A brief preliminary description of this regulator was published in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of February 6, 1915, page 271.

FIRE HAZARDS DUE TO STATIC ELECTRICITY IN DRY-CLEANING ESTABLISHMENTS.

Many Fires Caused by Frictional Electricity Having No Relation Whatever to Electric Service.

Many textile fabrics cannot be cleaned with soap and water without serious risk of spoilage due to shrinkage, running of the colors, etc. Proper cleaning of such goods requires use of gasoline, benzine, naphtha, or other volatile liquids, the general process being called "dry cleaning." All these liquids are highly inflammable and their use in quantity constitutes a most serious fire hazard. This fact, combined with the special skill required for securing thorough and satisfactory cleaning by this process, is causing more and more of this cleaning to be done in special dry-cleaning establishments. From the standpoint of fire hazard this is a good tendency, since careless and unintelligent use of inflammable liquids, like gasoline, is one of the most prolific causes of fires in residences. By removing dangerous methods from the household to a special plant employing trained employees the number of fires should be very materially reduced. In such a plant provision can be made for scientifically minimizing the hazards inherent in the business and for promptly extinguishing any fires that may break out.

This subject was one of the chief topics for discussion at the annual convention of the Illinois Association of Dyers and Cleaners, which was held in Chicago recently. H. E. Mechling, president of the National Association of Dyers and Cleaners, in speaking on cleaning-plant construction, the fire hazard, and methods by which cleaning may be made safe, called attention to the danger from static electricity. Dr. Mechling advised having all machines in the plant well grounded, so that no possibility for accumulation of frictional electricity may exist. Thorough grounding of each workman employed at or near deterging or washing machines was also advocated, because static electricity may readily be developed on the body of the employee. If this static is not carried off a spark may be produced, which in the presence of the volatile vapors, may readily cause a fire. Many fires in plants of this character that have been ascribed to spontaneous combustion were doubtless really due to sparks resulting from static electricity. Other speakers described methods for grounding the workmen. In one plant the workmen's shoes are provided with copper rivets passing through the soles so as to make close contact with the perspiring feet. In another case a wet fiber mat is kept at such a place in the cleaning room as to necessitate the workmen passing over it frequently; this mat is kept quite moist and consequently keeps the soles of the shoes damp.

Among recent investigations of this subject one of the most thorough was that undertaken by John H. Vogt, chemical engineer for the Industrial Commission of New York. In a report dealing with elimination of the fire hazards in cleaning plants, he shows that during the process of rinsing goods in clean benzine, after they have received the first benzine wash, a crackling noise is frequently heard that is due to static electricity. This is particularly noticeable in the case of silks that have been bleached with sulphur dioxide, although all silks are quite susceptible to electrostatic effects in contact with benzine. Materials like cotton, linen, wool, silk, jute, and especially unwashed or undyed wool, become easily electrified when rubbed in a dry atmosphere; if these materials are rubbed or even moved about quickly in a bath of benzine, the latter is also electrified negatively, the fibrous goods being electrified positively. Benzine and these textiles being both bad conductors, an accumulation of electricity is likely to follow which is very apt to cause a spark in its equalization that may ignite the liquid or cause a violent explosion if a certain mixture of air and vapor is present. Mr. Vogt believes this to be the cause of a large number of fires in cleaning plants.

To overcome this danger he recommends grounding not only the machines, but also the workmen. For the latter purpose he advocates hanging chains in front of each machine, each chain being properly connected to a thoroughly grounded pipe, such as water pipe. The chain should be arranged to slip over the wrist of the operator and the latter should be required to be thus connected to the chain while removing goods from deterging machines. In this way, both operator and machine being grounded, the static will equalize itself without harm. Mr. Vogt also advises that employees be not permitted to wear rings, since these are likely to draw sparks.

To minimize the formation of static electricity, Mr. Vogt recommends humidifying the air in benzine washers by use of a steam jet so as to maintain a relative humidity of about 70 per-cent. This, moreover, warms the goods and at temperatures of 105 to 120 degrees Fahrenheit both fibers and textiles have lost much of their susceptibility to electrical excitation. With these recommendations carried out, along with many others aiming to minimize the breaking out of fire from other causes, Mr. Vogt points out that cleaning plants can be made as free from fire hazards as other industrial plants.

It should be carefully noted that the electrical hazards referred to above are due only to static electricity caused chiefly by friction and to a minor degree by electrochemical charges. They have nothing to do with the use of electric light or power in cleaning rooms. In fact, electricity for this purpose is by far superior to any other form of light or power. It can be installed with maximum safety. Electric lamps in vapor-proof fittings, squirrel-cage induction motors, inclosed switches and conduit wiring can be provided so as to make electric service in such premises the safest and cleanest means of furnishing abundant light and power.

COPPER TO BE FURNISHED GOVERNMENT AT HALF PRICE.

Patriotic Move On Part of Producers To Facilitate Preparedness Program.

The principal American copper producers have agreed to furnish the government copper needed for the army and navy during the coming year at 16.6739 cents a pound scarcely one-half of the current market price. Forty-five million pounds is the amount to be delivered.

The action of the copper producers was announced by the council of national defense, which made public a letter from the producers to B. M. Baruch of New York, chairman of the council's metal supply committee.

After stating that the producers of copper "will furnish the quantity named for delivery within 12 months—viz.: 20,000,000 pounds for the navy and 25,510,000 pounds for the army in approximately equal quantities each quarter from April, 1917, to April, 1918, at a price of 16.6739 cents per pound, delivered in regular shapes at Atlantic seaboard points," the letter continues:

"The price named is the actual average selling price obtained by the United Metals Selling Company, the largest seller of copper, over the period of 10 years, 1907 to 1916, inclusive, and represents, in our opinion, the fair average price of all copper sold by American producers during that time.

"We offer the copper at this price notwithstanding our cost for labor, materials, supplies, etc., varies from 30 to 75 per cent above the average during the 10 year period because we believe it to be our duty to furnish the requirements of the government in preparing the nation for war with no profit more than we receive from our regular production in normal times."

Load, Plant and Connected-Load Factors

A Graphic Analysis of the Common Factors With Actual Problems Showing Their Application

By TERRELL CROFT

This is the second of a series of three articles by Mr. Croft dealing with operating factors of interest to central-station engineers and operators. The present installment relates particularly to "plant-factor" and shows the distinction between this and "load-factor." The first article described "load-factor" and "operating-time load-factor." The concluding article in this series will be published in an early issue.

PLANT-FACTOR, according to the Standardization Rules of the American Institute of Electrical Engineers, is "the ratio of the average load to the rated capacity of the power plant, i. e., the aggregate ratings of the generators." That is:—

$$(16)\quad \text{Plant-factor} = \frac{\text{average load}}{\text{rated capacity of plant}}$$

(17) Average load = (plant-factor) × (rated capacity of plant).

$$(18)\quad \text{Rated capacity of plant} = \frac{\text{average load}}{\text{plant-factor}}$$

Example.—The generating equipment in a certain central station comprises two 600-kilowatt (continuous rating), turbogenerator units. It is assumed that the average power load imposed on the station is 255 kilowatts, what then is its plant-factor?

Solution.—From formula (16) above: plant-factor=(average load) ÷ (rated capacity of plant of generators) = 255 kilowatts ÷ (600 kilowatts + 600 kilowatts) = 255 ÷ 1,200 = 0.212. That is, the plant-factor is, on a continuous-rating basis, 21.2 per cent.

There may be an annual and an operating plant-factor just as there may be an annual and an operating load-factor, as discussed in the preceding article. In fact, plant-factor may be determined over any suitable period of time just as can load-factor. Note that "plant-factor" applies only to energy-generating or delivering apparatus and that it does not apply to energy-consuming apparatus. While the explanatory definition as given in the A. I. E. E. Standardization Rules refers specifically to the "aggregate ratings of the generators," plant-factor may properly be computed on the basis of the output of any energy-delivering plant—not necessarily a generating plant. Thus, a plant-factor may refer to the output of a transformer, motor-generator, synchronous converter or any similar sort of a substation.

A plant-factor does not have a definite meaning unless the method used in rating the capacity of the station is specified. The station may be rated on a "normal-power-capacity" basis or on a "continuous" or "maximum-power-capacity" basis and the continuous capacity may be from 25 to 40 per cent or more, greater than its normal capacity.

The continuous rating of a piece of electrical apparatus is that rating—usually expressed in horsepower or kilowatts, but sometimes in amperes—at which the machine or device may operate continuously without its limitation being exceeded. That is, without its becoming so overloaded that it will be overheated and damaged or become unsafe, inefficient or operate with a poor performance. A continuous rating is often referred to as a maximum rating.

The American Institute standardization rules, section 281, states: "A machine rated for continuous service shall be able to operate continuously at its rated output without exceeding its limitations dictated by: (1) operating temperature, (2) mechanical strength, (3) commutation, (4) dielectric strength, (5) insulation resistance, (6) efficiency, (7) power-factor, (8) wave shape, (9) regulation.

Most types of electrical machinery may be given either "normal" or "maximum" ratings. The normal rating indicates the load which the machine will carry continuously and with a certain overload for a specified time. The maximum or continuous rating indicates the load which the machine will carry continuously but without any overload. Thus a generator of a certain size and of a certain manufacture is given a normal rating of 100 kilovolt-amperes. This means that the machine is capable of carrying continuously a load of 100 kilovolt-amperes, and that it will also carry an overload of 50 per cent for one hour after it has been continuously carrying its 100-kilovolt-ampere, normal load. Furthermore this same machine will carry 135 kilovolt-amperes continuously (35 per cent over its normal rating), and hence can be called a 135-kilovolt-ampere maximum—or continuous—rating machine.

The generator discussed had a normal rating of 100 kilovolt-amperes and a continuous or maximum rating of 135 kilovolt-amperes. The present tendency is to give all electrical machinery only one rating—the continuous. This will tend to minimize the confusion relating to ratings which now exists. Practically all generators and transformers are now rated only on the maximum (the continuous-carrying-capacity) basis.

Capacity-Factor.

The importance of maintaining the plant-factor as high as possible will be apparent from a consideration of the discussion given in a succeeding paragraph relating to load-factor. In general, the lower the plant-factor of a station the greater will be its cost of producing energy.

"Capacity-factor" is, probably, a better and more general term than "plant-factor" because, strictly speaking, the word "plant" limits the use of the term "plant-factor" to the total output of a plant of some sort. But "capacity-factor" may be properly used as relating to the output of an energy-delivering plant or to the output of any individual unit or group of equipment in the plant or station. Thus, there may be a capacity-factor for a station and a capacity-factor for any generator or motor-generator in a station. It is not unlikely that, because of its more general application "capacity-factor" may supersede "plant-factor."

The distinction between plant-factor, load-factor and capacity-factor should be clearly understood because the terms are sometimes, though incorrectly, used interchangeably. The term "load-factor" is frequently used where "plant-factor" is really meant. Some writers of standing thus use "load-factor" incorrectly but, since the term is accurately defined by the American Institute rules, it appears best to adhere rigidly to the definition there given. "Load-factor" is the ratio of average power to maximum demand while "plant-factor" is the ratio of average power to rated station capacity. Furthermore, "load-factor" may relate either to the energy-delivering or energy-receiving equipment while "plant-factor" relates specifically to delivering equipment. The distinction between "plant-factor"

and "capacity-factor" is that "plant-factor" relates specifically to the total output of an energy-delivering station, while "capacity-factor" may relate to the output of any energy-delivering station, machine, system or equipment. Note that "plant-factor" is really a special restricted case of "capacity-factor."

Connected-Load Factor.

Connected-load factor is the ratio of the average power input to the connected load. It is expressed as a percentage

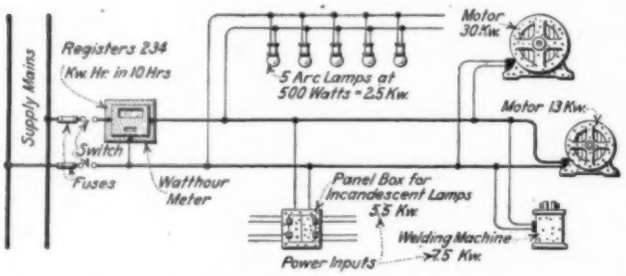


Fig. 1.—A Connected-Load-Factor Problem.

and relates only to receiving equipment. As with load-factor, to render this value specific, the period over which the power is averaged should be specified. Usually the average is taken over a year and if no period is mentioned a year is ordinarily implied. From the above definition it follows that:

$$(19)\quad \text{Connected-load factor} = \frac{\text{average power input}}{\text{connected load}}$$

(20) Average power input = (connected-load factor) × (connected load).

$$(21)\quad \text{Connected load} = \frac{\text{average power input}}{\text{connected-load factor}}$$

The average power input and the connected load must be expressed in the same units. If the power input is expressed in kilowatts, the connected load should then also be expressed in kilowatts. If the power input is expressed in horsepower, the connected load should be expressed in horsepower. The connected-load value used should be based on the output capacity of the equipment involved and not on the input capacity.

Connected-load factors are most useful in finding the probable average power input or the probable annual energy consumption of an installation when the connected load and the connected-load factor applying to it are known. A distinguishing feature of connected-load factor is that it relates only to energy-consuming apparatus. A comparison of equation (19) with those of (1)* and (16) will disclose the distinction between this and the other factors herein considered.

To insure that a connected-load factor has a definite meaning it is necessary to specify the basis on which the connected load is computed. "Connected load" should, strictly speaking, always be stated on a continuous-rating basis. However, it is not always feasible to follow this method. A lighting "connected load" is equal to the sum of the watts of all of the lamps in the installation. A motor "connected load" is equal to the sum of the rated (name plate) outputs of all the motors. Motors are usually rated in horsepower output; hence, it is usually most convenient to reduce these horsepower values to equivalent kilowatt values before adding them together. Motors are now ordinarily rated on a "normal" output basis, but a "continuous" rating is now sometimes given to motors. It is not improbable that, in the future, all motors may be rated on a "continuous" basis.

*See issue of March 10, 1917.

Example.—What is the connected-load factor of the installation shown in Fig. 1 on a one-day (10-hour) basis? The watt-hour meter records 234 kilowatt-hours as having been used during a certain 10-hour day. Full-load output (name plate, normal basis) ratings in kilowatts are indicated in the illustration near each piece of apparatus.

Solution.—The average load for the 10-hour day is $234 \div 10 = 23.4$ kilowatts. Now substitute in equation (19): connected-load factor = (average load) ÷ (connected load) $= 23.4 \div (2.5+5.5+30+7.5+13) = 23.4 \div 58.5 = 0.4 = 40$ per cent.

Example.—The combined motor and lighting load diagrammed in Fig. 2 is installed in a foundry. What average annual load may this installation be expected to impose on the central station and what will be the probable annual (8,760-hours) energy consumption? *Solution.*—The annual approximate connected-load factor is known from published data to be 11 per cent. The equivalent rated connected load (normal ratings of motors) in kilowatts, is, as shown by the power output symbols P_o:—$11.2+22.4+5.6+29.8+11.2+37.3+22.4+3.7+1.3 = 144.9$ kilowatts. Now substitute in equation (20): average power input = (connected-load factor) × (connected load) $= 0.11 \times 144.9 = 15.9$ kilowatts. Hence, the average power load imposed by this plant on the central-station system would, probably, be about 16 kilowatts. To ascertain the kilowatt-hour energy consumed annually, substitute in equation (6): kilowatt-hours expended during period = (average power) × (number hours in period) $= 15.9 \times 8{,}760 = 139{,}284$ kilowatt-hours.

Connected-load factor equals the product of demand-factor and load-factor as will be shown. By definition, see equation (19).

$$(22)\quad \text{Connected-load factor} = \frac{\text{average power input}}{\text{connected load}}.$$

But, as shown in equation (2)*:

(23) Average power input = (load-factor) × (maximum demand). Furthermore, it can, on the basis of definition, be shown that:

$$(24)\quad \text{Connected load} = \frac{\text{maximum demand}}{\text{demand-factor}}.$$

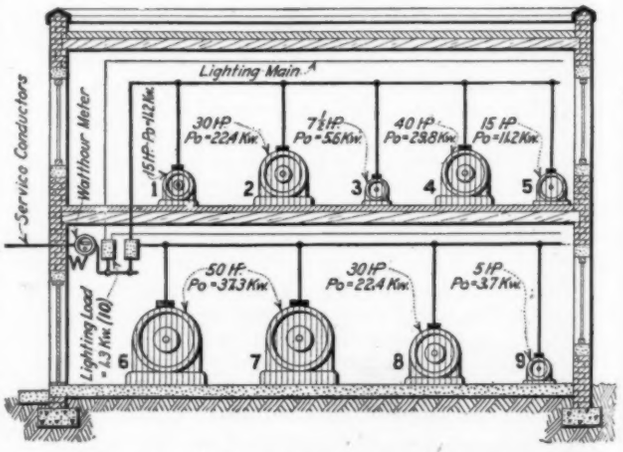


Fig. 2.—Example of Application of Connected-Load Factor.

Now, substituting the expressions for average power input of (23) and for connected load of (24) in equation (22) the result is:

$$(25)\quad \text{Connected-load factor} = \frac{(\text{load-factor}) \times (\text{maximum demand}) \times (\text{demand-factor})}{\text{maximum demand}}$$

The expression maximum demand appears in both numerator and denominator of the above equation, hence "cancels out" and the resulting working formula is:

(26) Connected-load factor = (load-factor) × (demand-factor).

(To be continued.)

Meeting of Electrical Manufacturers

Reports and Discussions at Annual Convention of Associated Manufacturers of Electrical Supplies Held in New York Indicates Much Constructive Work Is Being Accomplished

THE annual meeting of the Associated Manufacturers of Electrical Supplies was held at Delmonico's, New York City, Thursday afternoon, March 15, 1917, beginning at two o'clock. In the absence, because of ill health, of President R. K. Sheppard, the meeting was called to order by Judge Thomas M. Debevoise, counsel of the Associated Manufacturers, who presided. H. B. Crouse, of Syracuse, vice-president, read President Sheppard's address. This, in large part, is as follows:

Address of President Sheppard.

At the close of this second year we have sound reasons to be glad that we are banded together in this Association. Enduring friendships have multiplied. Trusting our comrades, our trust has been reciprocated. Contributing frankly and freely from the discoveries of our manufacturing past to remedy mistaken or uneconomical practices, we still have not given more than we have received from our associates in this enterprise.

The organization into Sections has laid permanent foundations. Recently, by unanimous vote, one of the Sections recommended to the Underwriters' Laboratories that an adequate method should be provided whereby approval under the installation rules of the National Fire Protection Association should be given without unreasonable delay to new products, when such products had been thoroughly tested by the Underwriters' Laboratories and found to be safe and suitable for the intended service. That competing manufacturers should thus unitedly endorse a sound principle, which makes for fair dealing between competitors and towards the consumers of electrical products, is a splendid testimonial to their unselfishness and the integrity of their purpose to deal justly by one another.

One of the youngest of the Sections, established only last fall—the Carbon Section—has already accomplished standardizations which for years had been recognized as desirable, but hopelessly difficult to achieve. The Molded or Formed Insulation Section has published and distributed widely an important pamphlet treating on test methods suitable for many of the products in which that Section is interested. The activities of the Line Material Section, the Fan Motor Section, the Outlet Box Section, the Fuse Section, have disclosed how the frank exchange of manufacturing or engineering information on one theme, recognized as of common interest, inevitably leads to the consideration of other pertinent subjects. The Panelboard and Switchboard Section has condensed into compact form a number of clean-cut, simply-expressed suggestions on "Customs of the Trade" showing therein how easily some prevalent trade abuses may be suppressed by a manufacturer who is unwilling to be ruled in those matters by the customers to whom he sells. In the Wire and Cable Section the spirit of good fellowship has increasingly permeated successive Section meetings with its beneficent influence. The Lighting Fixture Section consists of three autonomous committees. The Interior Conduit Section consists of four. Other divisions also of the electrical industry have found autonomous committees the most useful division of their Section organization. In other divisions, such as the Porcelain Section, such complete segregation is not needed.

The promotion era of the electrical industry is over. Now that industry must be classed as one of the basic industries of the country like steel production, cotton manufacturing, machinery building, railroading, mining of coal and minerals. For it the age of wonders still holds some secrets, but when disclosed they will constitute refinements of the art, rather than fundamental forces in this enormous business.

Under appointment by the Electrical Manufacturers Council a committee led by C. E. Patterson of the General Electric Company has prepared a comprehensive, yet very flexible plan of accounting and cost estimating which, ere long, will be available to all of our association members

With the Underwriters' Laboratories the relations of our members have been increasingly harmonious and mutually beneficial. The Laboratories have established many industry conferences which are integral parts of the organization of the Underwriters' Laboratories. In those conferences representative manufacturers advise and consult with the officials and engineers of the Laboratories concerning suitable test methods and requirements for the Laboratories to adopt, and desirable changes in standards to be recommended to the Electrical Committee of the National Fire Protection Association. When standards are to be discussed or adopted, surely men are wise to combine with laboratory theory and findings the practical experience obtainable only in the factories which produce the goods that are supposed to compare favorably with the desired standards.

The founding of Industry Conferences was a wise act which has so related the activities of the Underwriters' Laboratories to the necessities of the manufacturers, that the rulings of the Laboratories, promulgated from time to time, generally find hearty endorsement by the manufacturers whom they affect. It is desirable that other governing bodies throughout the country should realize how greatly the policy of the Laboratories has promoted the adoption of reasonable and attainable standards for the ultimate benefit of our entire people.

As we stand at the beginning of the third year of our work, every prospect pleases. The perplexities of our infancy are dispelled. The general form of our organization is sufficiently flexible to permit every new Section to be operated by its members with thorough adaptation to its particular interests.

Through the Board of Governors, you may employ expert certified accountants to whom confidential data may be delivered with assured secrecy. Such accountants would combine the individual reports of a group of manufacturers and subsequently distribute to each of the totals, or the averages, or such other details as the members of that group might require. Your Board of Governors might use the same accountants for the work of several different Sections, segregating to each Section its rightful proportion of the charges of those accountants.

Report of Finance Committee.

Chairman J. F. Kerlin, of the Finance Committee, reported that the Association was out of debt and had a balance of $556.11 in the treasury. The Finance Committee, which is composed of Chairman Kerlin and W. C. Bryant, R. E. Gallaher, J. N. Shreve and C. L. Eidlitz, complimented the treasurer of the Association, J. W. Perry, for his excellent work and called attention to the fact that not one dollar of dues remained unpaid on March 1, 1917.

The general secretary, Charles E. Dustin, then presented his report.

Report of the Secretary.

The report of the general secretary commented on the membership growth and dealt at some length with the activities of the Association. Many lines of activities have been undertaken by the Sections during the year, and after acting upon the ordinary topics of standardization of design as well as matters of interest with the Underwriters' Laboratories, many of the Sections have now specifically taken up the compilation of statistics as pertaining to products handled by the members, figures being first submitted to the general secretary and tabulated by his office and the net results given to each of the members, without disclosure of the name of the individual manufacturer. There are at present 156 member companies.

Great progress has been made by co-operation of the manufacturers in the matter of a uniform basis for figuring costs. Articles manufactured by different members have been taken and costs submitted through the office of the general secretary. It is interesting to note that these figures have shown a variation of from 25 to '40 per cent on same article, indicating an improper distribution of expense items, and proving conclusively the necessity of adopting a uniform system of cost accounting.

In each Section a Cost Accounting Committee has been appointed. These committees are working on systems applicable to the products of their own particular sections, but no reports have been made or adopted as it was thought wise to withhold all reports of these committees, pending the report of the Cost Accounting Committee of the Electrical Manufacturers' Council.

In most Sections committees have been appointed to work with the Industry Conference Committee of the Underwriters' Laboratories, and the results of the work of standardization and approval of electrical supplies have been invaluable.

In the Fuse Section a standard for cartridge inclosed fuses has been prepared, which has resulted in an approval by the Underwriters and the recommendation that it be adopted as standard in the National Electrical Code, as issued by the National Fire Protection Association. The preparation of the Fuse Manual has involved an expenditure in cash of $940, which was borne by ten members of the Fuse Section.

In the Molded or Formed Insulation Section a Committee was appointed to consider a standard method for testing molded insulation, and a Bulletin has been issued known as Standards Committee Bulletin No. 1, the first of a series to cover all the important properties of molded insulation.

A great diversity in the method of handling its product led one of the Sections to consider a list of customs of the trade. Naturally this involved a long and varied discussion, but in the end a list of customs were approved and recommended for adoption, although not in any way obligatory upon the members, all tending to mitigate many of the evils peculiar to that particular branch of the industry.

Council Report.

D. H. Murphy, chairman of the Electrical Manufacturers' Council presented his report covering the activities of the Council during the past year. The Electrical Manufacturers' Council was organized for the purpose of coordinating the work of the Electrical Manufacturers' Club, the Electric Power Club and the Associated Manufacturers of Electrical Supplies, as well as of any other organizations which might later be represented, the idea being to furnish a clearing house for all questions of common interest so that conflicting action will be avoided and concerted action taken where necessary. The Council has been in existence a little over a year, and has held several meetings at which many questions of interest to the entire industry have been discussed.

One of the subjects now under consideration for example is the question of standardization of sizes of literature for the electrical manufacturing industry. A committee has been appointed by the Council with instructions to confer with like committees appointed by the Electrical Manufacturers' Club, Electric Power Club and the Associated Manufacturers of Electrical Supplies, for the purpose of assembling all available data on the subject.

Perhaps the most important subject which has been considered by the Council is uniform cost accounting. Delegates from all three of the manufacturing organizations composing the Electrical Manufacturers' Council, were requested by their respective organizations to bring before the Council the question of the immediate formation of a committee to investigate the possibilities of uniform cost accounting and to decide upon and recommend measures and methods for securing such uniformity.

Report of Molded Insulation Section.

E. B. Hatch, chairman of the Molded or Formed Insulation Section, reported that the Section had done some constructive work during the year, notably the preparation of a manual covering standard methods of testing molded insulation. This manual has been adopted by the Underwriters' Laboratories, Bureau of Standards and by most of the users of electrical insulation. It has also received very favorably comment from a number of scientific societies abroad as well as in this country, and has had a number of applications for the manual.

When the Section was formed it was rather large and unwieldly, consisting of some 45 member companies, and while all were manufacturers of molded insulation, or rather, electrical insulation, they represented such a wide variety of products that they had few interests in common.

Report of Committee on Electric Wiring Systems.

Le Roy Clark, chairman of the Committee on Electric Wiring Systems, presented a very interesting report covering the activities of this committee, which is the outgrowth of the Committee of Business and Technical Experts appointed in 1914. That committee has gradually been enlarged. Its work primarily at the start was the consideration of the subject of concentric wiring, but it soon developed that that was too narrow a subject, and in order to do better work it was enlarged to include all of the representative electrical bodies, the work to be made an investigation of wiring systems, with the possibility of developing some system of wiring which would be not only cheaper, but also safer.

The committee now has representatives from the following organizations, aside from the manufacturing representatives who have been on it from the start: National Electric Light Association, Western Association of Electrical Inspectors, International Association of Municipal Electricians, American Institute of Electrical Engineers, Associated Factory Mutual Fire Insurance Companies, Underwriters' Laboratories, Bureau of Standards, Electrical Supply Jobbers' Association, and National Electrical Contractors' Association.

Aside from that there are two technical experts, Gano Dunn, of the J. G. White Engineering Corporation, and D. C. Jackson, of the Massachusetts Institute of Technology. The committee, therefore, is broadly constituted and its work it is hoped will be equally broad. During the last year the work has been entirely confined to the work of a sub-committee investigating the subject of bare-ground-return wiring systems. Wiring systems would be

naturally divided into two classes, insulated systems and partially insulated systems. Concentric wiring was only one of the possibilities in a ground-return system, therefore, the committee considered not only concentric wiring, but any form of bare-ground-return wiring system.

The chairman of that sub-committee made a report at the morning session of the larger committee. That report will be printed and distributed—not for general publication, as it is not a final report; it is simply a report of the sub-committee, reporting to the larger committee. That committee after receiving this report and taking it up with the various organizations represented, will then be in a position to consider the final report which they will make on this subject.

Mr. Corrigan and five other gentlemen have done a tremendous amount of work in the last year collecting the data on this subject. Mr. Corrigan then read the report, which was received with much applause.

On motion of J. H. Trumbull, seconded by R. E. Gallaher, the following-named governors were elected to serve for three years from April 1, 1917: A. W. Berresford, Cutler-Hammer Manufacturing Company; L. W. Downes, D. & W. Fuse Company; E. B. Hatch, Johns-Pratt Company; B. E. Salisbury, Pass & Seymour, Inc.; R. K. Sheppard, Simplex Wire & Cable Company.

It was voted to change the by-laws by eliminating the provision requiring the number of nominations to be twice as large as the number of governors to be elected, and providing that the list of nominees sent out by the Nominating Committee could be added to by five members submitting an additional name or names, said supplementary list to be forwarded to the general secretary not less than seven days before the date of the meeting.

It was voted to approve a new lease for headquarters located in the Forty-second Street Building, New York.

Tariff Committee Appointed.

A general Tariff Committee was authorized, to be appointed by the Board of Governors, following remarks by L. Livingstone, of Edward F. Caldwell & Company, who said that the present duty on fixtures is 20 per cent. Prior to the reduction of the tariff it was 45 per cent. We have been told, Mr. Livingstone stated, by authentic sources that through the activities on the part of some of the German manufacturers in Germany and also in Japan they succeeded in interesting certain people in Washington in order to have this reduction effected.

Senator Wadsworth in an address recently made before the Merchants' Association, stated it was impossible for a senator or any congressman, unless he received the co operative support of manufacturers, to read the different laws that were promulgated, and at that time, when this reduction was made there was no interest taken whatever by the manufacturers of this country to keep the duty to 45 per cent, which it was heretofore, hence the reduction to 20 per cent.

"Think what we will have to compete with at the end of this war" he said. "Germany is a highly efficient country. At the present time they are training their women for the works of the different industries. At the end of this war men will come back from the trenches, which will mean competition of labor between men and women. What does that mean? A reduction in the wages. At the present time they are under military discipline—self-sacrificing—highly efficient. We today are wasteful, paying high wages. I contend that we ought to equalize this; form a committee to present statistics to this Tariff Committee in order to equalize the tariff to bring it on a basis where the American manufacturer can compete with the foreign manufacturer. I suggest that a committee be appointed."

Annual Banquet.

In the evening a very enjoyable banquet was held at Delmonico's, Judge Debevoise acting as the graceful and tactful toastmaster. The speakers were E. N. Hurley and Judge Job E. Hedges, both addresses being particularly instructive and interesting. Judge Hedges' patriotic remarks received great and long-continued applause.

President Herbert A. Wagner, of the National Electric Light Association, telegraphed from Baltimore as follows: "Extremely sorry that I shall be unable to attend your banquet this evening in response to your kind invitation. Particularly regret missing an opportunity for expressing to your Association cordial greetings, good wishes and active desire of the National Electric Light Association to co-operate with your organization and members in every way possible in solving the many problems which we have in common."

The attendance at the meeting and at the banquet was quite large, and very enthusiastic, about 175 being present. Among those in attendance were the following:

A. A. Wire Company, Newark, N. J.—W. C. Hall.
Frank Adam Electric Company, St. Louis, Mo.—Fred B. Adam.
Adapti Manufacturing Company, Cleveland, O.—J. C. Boyton.
Alphaduct Company, Jersey City, N. J.—Russel Dart, Russel S. Dart.
American Carbon & Battery Company, East St. Louis, Ill.—Harold J. Wrape.
American Circular Loom Company, New York City—Oscar Hoppe, George A. Lutz.
American Conduit Manufacturing Company, Pittsburgh, Pa.—D. H. Murphy, H. B. Kirkland.
American Electrical Works, Providence, R. I.—Edgar H. Hammond.
Appleton Electric Company, Chicago, Ill.—A. I. Appleton.
Arrow Electric Company, Hartford, Conn.—Edward R. Grier, Ben C. Perkins.
Atlantic Insulated Wire & Cable Company, New York City—Edward Sawyer.
Brunt Tile & Porcelain Company, Columbus, O.—G. F. Brunt.
Belden Manufacturing Company, Chicago, Ill.—Joseph C. Belden, S. C. Schenck.
Benjamin Electric Manufacturing Company, Chicago, Ill.—Walter D. Steele.
Best Electric Company, Pittsburgh, Pa.—C. A. Vetter.
Boston Insulated Wire & Cable Company, Boston, Mass.—H. B. Burley.
Bourn Rubber Company, Providence, R. I.—Stephen W. Bourn, W. Howard Burney.
Bryant Electric Company, Bridgeport, Conn.—W. C. Bryant, F. V. Burton, C. A. Bates.
Edward T. Caldwell & Company, Inc., New York City—L. Livingston.
Central Tube Company, Pittsburgh, Pa.—J. H. Rodgers.
Chelten Electric Company, Philadelphia, Pa.—Philip H. Ward, Jr.
Chicago Fuse Manufacturing Company, New York City—Arthur D. Dana.
Condit Electrical Manufacturing Company, Boston, Mass.—S. B. Condit, Jr., Fred W. Macon, W. S. Brown.
Connecticut Electric Manufacturing Company, Bridgeport, Conn.—A. H. Trumbull.
Cook Pottery Company, Trenton, N. J.—Charles Howell Cook.
Corliss Carbon Company, Bradford, Pa.—A. Mullhaupt, Jr.
Crescent Insulated Wire & Cable Company, Trenton, N. J.—E. T. Phillips, H. R. Sharkey.
Crouse-Hinds Company, Syracuse, N. Y.—H. B. Crouse, A. F. Hills.
Cutler-Hammer Manufacturing Company, Milwaukee, Wis.—A. W. Berresford, A. H. Fleet, F. E. Layman.
D. & W. Fuse Company, Providence, R. I.—W. S. Sisson, R. C. Patton.
Detroit Fuse & Manufacturing Company, Detroit, Mich.—W. F. Hessel.
Detroit Insulated Wire Company, Detroit, Mich.—J. H. Hunter.
Dickinson Manufacturing Company, Springfield, Mass.—Kurt R. Sternberg.
Diehl Manufacturing Company, Elizabeth, N. J.—John H. Barker.
Drew Electric & Manufacturing Company, Indianapolis, Ind.—James H. Drew.
Eastern Flexible Conduit Company, Brooklyn, N. Y.—Frank J. Saxton, Cyrus W. Johnson.
Electric Cable Company, New York, N. Y.—Edwin W. Moore, J. Nelson Shreve.
Electric Storage Battery Company, Philadelphia, Pa.—Charles Blizard, Albert Taylor.
Electric Fuseguard Company, Inc., Newark, N. J.—William D. Ligon.
Electric Service Supplies Company, Philadelphia, Pa.—A. H. Englund, H. G. Lewis.
Electrose Manufacturing Company, Brooklyn, N. Y.—Louis Steinberger.
Empire China Works, Brooklyn, N. Y.—Charles H. Jensen.
Enameled Metals Company, Pittsburgh, Pa.—John S. Patterson.
E. H. Freeman Electric Company, Trenton, N. J.—George E. Maguire.
I. P. Frink, New York City—W. H. Spencer.
General Electric Company, Schenectady, N. Y.—D. C. Durland, Frank W. Hall, H. R. Sargent, J. C. Dallam, S. H. Blake, Charles E. Wilson, William T. Ruete, W. R. Williams.
B. F. Goodrich Company, Akron, O.—Thomas L. Barnes.
Habirshaw Electric Cable Company, Inc., New York City—James B. Olsen, Grenville F. Waterbury, Fred J. Hall.
Hart & Hegeman Manufacturing Company, Hartford, Conn.—Shiras Morris.
Hart Manufacturing Company, Hartford, Conn.—F. E. Watts.
Hartford Faience Company, Hartford, Conn.—Fred L. Bishop.

Hazard Manufacturing Company, Wilkes Barre, Pa.—J. C. Bridgman.
Hemming Manufacturing Company, Garfield, N. J.—B. H. Howell, B. A. Appleton.
Harvey Hubbell, Inc., Bridgeport, Conn.—Harvey Hubbell, Paul Blackburn, W. G. Ward, T. S. McLean, G. S. Hadley, A. W. Gray, H. W. Bliven.
Illinois Electric Porcelain Company, Macomb, Ill.—C. W. Kettron.
Imperial Porcelain Works, Trenton, N. J.—B. B. Dinsmore.
H. W. Johns-Manville Company, New York City—J. W. Perry.
Johns-Pratt Company, Hartford, Conn.—E. B. Hatch, R. C. Buell, R. C. Cole.
Killark Electric Manufacturing Company, St. Louis, Mo.—W. Douglas Woolley, George L. Hathaway.
Krantz Manufacturing Company, Inc., Brooklyn, N. Y.—H. F. Krantz.
Locke Insulator Manufacturing Company, Victor, N. Y.—B. A. Plimpton.
The Macallen Company, Boston, Mass.—L. D. McCarthy.
Metropolitan Electric Manufacturing Company, Long Island City, N. Y.—P. J. Shelley.
Mitchell-Rand Manufacturing Company, New York City—William E. G. Mitchell.
National Carbon Company, Cleveland, O.—John F. Kerlin.
National India Rubber Company, Bristol, R. I.—A. H. Emerson, George A. Cragin.
National Metal Molding Company, Pittsburgh, Pa.—W. C. Robinson, C. E. Corrigan, H. G. Knoderer.
New England Electrical Works, Lisbon, N. H.—B. S. Webb.
New York Insulated Wire Company, New York City—R. E. Gallaher, L. O. Brewster.
National Electric Porcelain Company, Carey, O.—W. S. Bish.
Ohio Brass Company, Mansfield, O.—A. L. Wilkinson, N. M. Garland.
W. R. Ostrander & Company, New York City—C. P. LaShelle.
Pass & Seymour, Inc., Solvay, N. Y.—B. E. Salisbury, J. E. Brooks, H. J. Morey.
H. T. Paiste Company, Philadelphia, Pa.—H. T. Paiste.
Perkins Electric Switch & Manufacturing Company, Bridgeport, Conn.—G. W. Goodridge.
Pittsburgh High Voltage Insulator Company, Derry, Pa.—C. M. Semler.
Pratt Chuck Company, Frankfort, N. Y.—Mr. Sherman.
Pringle Electrical Manufacturing Company, Philadelphia, Pa.—William T. Pringle.
Robbins & Myers Company, Springfield, O.—A. F. Chamberlain, W. W. Mumma.
Rome Wire Company, Rome, N. Y.—C. R. Keeney, H. A. Hammond.
Safety Insulated Wire & Cable Company, New York City—LeRoy Clark, G. M. Haskell.
Saylor Electric & Manufacturing Company, Wheeling, W. Va.—Frank D. Saylor.
Shapiro & Aronson, New York City—A. F. B. Harraden.
Speer Carbon Company, St. Mary's Pa.—J. S. Speer, G. P. Fryling.
Stackpole Carbon Company, St. Mary's, Pa.—H. C. Stackpole, W. J. Mills.
Standard Underground Cable Company, Pittsburgh, Pa.—C. J. Marsh.
Star Porcelain Company, Trenton, N. J.—Herbert Sinclair, Frank F. Gardinor.
Thomas & Betts Company, New York City—Hobart D. Betts.
R. Thomas & Sons Company, East Liverpool, O.—H. R. Holmes, J. E. Way.
Trumbull Electric Manufacturing Company, Plainville, Conn.—J. H. Trumbull, W. G. William.
Tubular Woven Fabric Company, Pawtucket, R. I.—W. H. Thornley, W. E. Sprackling.
Union Electric Company, Trenton, N. J.—Joseph W. Mackenzie, W. I. Peacock.
V. V. Fittings Company, Philadelphia, Pa.—William Gloeckner.
Waclark Wire Company, New York City—F. W. Wallace.
Weber Electric Company, Schenectady, N. Y.—John Weber.
Western Electric Company, New York City—Gerard Swope.
Western Conduit Company, Youngstown, O.—George F. Holly, H. S. Walker.
Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.—J. J. Gibson.
Wheeler Reflector Company, Boston, Mass.—C. O. Baker.
Yost Electric Manufacturing Company, Toledo, O.—F. H. Chapman.

Among others in attendance were W. W. Low (of Chicago), Walter Cary, Ray L. Lillibridge, George W. Elliott, Charles W. Price, A. Hall Berry, H. C. Cushing, Jr., and W. H. Onken.

Equipment and Activities of the Bureau of Standards.

At the meeting of the Electric Club-Jovian League of Chicago held on March 15, E. B. Rosa, chief physicist of the Bureau of Standards, Washington, D. C., gave an illustrated talk on the work of this very important institution. The Bureau was established about 16 years ago and has steadily grown since then. It has a group of laboratory buildings costing about $2,000,000 and located on a plot of 17 acres in the suburbs of Washington. The personnel numbers some 400.

Dr. Rosa stated that the work of the Bureau is concerned with five classes of standards, these being standards of measurement, standard values of physical constants, standards of quality, of performance, and of practice. This order represents roughly also the order in which the activities of the institution have been broadened. The Bureau is the national repository and authority on standards of length, mass, and the great number of other physical properties on the accurate measurement of which the commerce and industry of the country depend. It makes many tests of materials and products purchased by the Government for its various departments and aids in drawing up standard specifications for such purchases. It also has been authorized to draft standards of practice, particularly of utility service and safety, of which the standards for electric and gas service and the National Electrical Safety Code are examples; a similar gas safety code is being drafted.

In recent years the Bureau has been called upon to do more and more research work and scientific investigation, not only of matters dealing directly with standards, which has been conducted from the start, but of methods aiming to promote industrial development and better quality of products. Dr. Rosa cited railroad car wheels and rails as examples; investigation has clearly shown that a large proportion of railroad accidents is due to broken rails and wheels, which evidently calls for a careful study of present defects of methods of manufacture or installation. This investigation is being conducted along original lines by including not only physical, chemical, micrometallurgical and other commonly applied tests, but also magnetic tests that are bringing interesting results.

By means of lantern slides Dr. Rosa showed a large number of exterior views of the buildings, views in the numerous laboratories, illustrations of many pieces of special apparatus and test machines, and of test results and curves. He referred particularly to the testing of electrical standards and instruments, photometric tests of electric lamps, electrolysis investigations, etc.

Nominations for Officers of American Institute of Electrical Engineers.

At the meeting of the Board of Directors of the American Institute of Electrical Engineers held in Chicago on March 9, the report of the Committee of Tellers of its canvass of the nomination ballots cast for candidates for the Institute offices falling vacant July 31, 1917, was presented. The Board then selected by ballot its list of "directors' nominees," as follows:

President, E. W. Rice, Jr., Schenectady, N. Y.; vice-presidents, Frederick Bedell, Ithaca, N. Y., John H. Finney, Washington, D. C., A. S. McAllister, New York City; managers, Walter A. Hall, West Lynn, Mass., E. H. Martindale, Cleveland, O., Wm. A. Del Mar, New York City, Wilfred Sykes, Pittsburgh, Pa.; treasurer, George A. Hamilton, Elizabeth, N. J.

Mr. Rice, the nominee for president, is and has been since 1913, president of the General Electric Company. He has been associated with the company and its predecessors continuously since 1880. Mr. Rice is a man of great versatility and ability, combining in an exceptional manner the characteristics of the inventor, engineer, and executive, in each of which fields he has gained eminence.

Arrangements Being Made for Annual Convention A. I. E. E.

As already announced, the annual convention of American Institute of Electrical Engineers will be held at Hot Springs, Va., from June 26 to 29, the headquarters being at the Homestead Hotel. The convention will open with an address by President H. W. Buck, followed by reports of several technical committees. The two sessions on the second day of the meeting will be devoted to the general subject of high-tension cables and high-tension insulators. Papers will be presented by W. S. Clark, G. B. Shanklin, J. L. Harper, D. W. Roper, W. D. Peasley, H. J. Ryan, J. A. Brundige and A. O. Austin. On the third day there will be a mining session at which papers will be presented by R. L. Kingsland and R. S. Sage. On the last day of the convention there will be held a railway session at which several papers to be announced later will be presented.

COMMERCIAL PRACTICE

New-Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

Wiring 6,500 Old Houses a Year in Milwaukee.

During 1916 the Milwaukee (Wis.) Electric Railway & Light Company secured contracts for the wiring of 6,500 old houses and during the same year gained 10,000 customers. The company carries on a continuous house-wiring campaign, advertising consistently in the newspapers, street cars, and in other ways. The customer is permitted to pay for the cost of wiring and for the fixtures in easy payments extending over 12 months.

During January of 1917 contracts for the wiring of 350 old houses were secured and 400 in February. It is estimated by the company that the average for the months of March, April and May will be 500 or more.

Considerable of the success achieved in its house-wiring efforts is attributed by the company to its residence lighting rate which is based on the active-room plan. The rate comprises a preliminary charge of 10 cents per kilowatt-hour for the first four kilowatt-hours consumed per month for each of the first active rooms and for the first 2.5 kilowatt hours consumed per month for each of the active rooms in addition to the first four. There is a secondary charge of five cents per kilowatt-hour for all energy consumed per month in excess of that paid for at the primary rate up to seven kilowatt-hours per month per active room. For all energy consumed in excess of seven kilowatt-hours per active room per month the rate is two cents per kilowatt-hour.

FOR RENT
Down Came The Rent Sign!
A certain Milwaukee house had been vacant several months.
Take it all around, it was a very attractive house.
Time after time it was almost rented, but each time the prospective tenant finally decided he wanted Electric Service—and this house wasn't wired.
The owner eventually had the work done.
It didn't cost him as much as he thought it would; and the twelve months to pay made it easy.
One week after the house was wired it was rented.
Old house wiring is a mighty profitable investment.
More and more renters are insisting on ELECTRIC SERVICE.
When you wire a house you improve its rentability permanently.
If your house is not wired, 'phone Grand 123 and learn how simply and inexpensively it can be done.
The Electric Company

A Recent House-Wiring Advertisement of the Milwaukee Company.

All wiring is done by outside contractors, the company financing the installation.

The accompanying illustration shows a recent advertisement directed to house owners and calling attention to the desirability of wired houses.

Financing Motor Installations Meets With Success in Cincinnati.

The public service company, to be progressive, must not only adopt modern methods, but must continually seek means of inspiring in the public a friendly attitude toward the company. Selling household electric appliances, on a trial plan, has proved a splendid means of popularizing the use of these appliances, and of winning the confidence of this class of consumers. This success has led central-station sales managers to ask if a similar plan cannot be worked out to develop a large power load.

In Cincinnati, according to F. I. Woltz, of the Union Gas & Electric Company, speaking before the Ohio New Business Committee, the forerunners of the trial motor plan were the trial campaigns for gas-furnace equipments, gas arcs, and large nitrogen-lamp units. The result of these campaigns in placing quickly a large number of appliances, and a more general adoption naturally following, revealed the wonderful possibilities of the trial proposition.

The method worked out for motor installations, however, was different from the ones before mentioned in that it was not given great publicity and was used as a final argument after the salesman had first tried every possible means and argument to get the business. The customer had been lead to the point where he wanted the service, and believed he would profit by it, but felt that the power salesman had perhaps underestimated the operating costs, or that a number of unforseen conditions would likely arise, and he would have to bear the burden of proof. If the power company, then, would assume the responsibility of proof, the contract could be closed.

Following is a brief outline of the trial motor proposition which was offered by the Union Gas & Electric Company at Cincinnati.

A letter was written to the prospective customer stating that if he would sign the standard power contract, the company would agree to install all the necessary wiring, motors, and starters, make the service connections, and supply the service for three months. During this time the customer would be under no obligations except to pay for current used according to the specified schedule. If at the end of that time the customer was not satisfied with the service, the wiring and motors would be removed and the plant would be restored to its original condition, and he would be under no further obligations. If, however, in the judgment of the customer, the service was as represented and was satisfactory, he would pay the agreed amount for the wiring and motors, and service would be continued under the terms of the contract.

Since the installation was to be made by the power company, the customer was requested to furnish the salesman with a list of motor manufacturers, and wiring contractors, from whom quotations were desired. The power company would then make propositions to these dealers, and those who were willing to co-operate would submit competitive bids direct to the customer. The wiring contractors submitted the same quotation to the power company and to the customer, and payment was made due in three months. The motor manufacturers were required to quote the power company a resale or dealer's price, which usually was 85 or 90 per cent of the retail or customer's price. The com-

pany agreed to make settlement with the manufacturer at the end of the three months' period, and to pay interest from the date the motors were delivered.

The company had the option, however, of returning the motors at the end of the trial period, but were required to pay 10 per cent of the total agreed price. This amount was assumed to cover the expense of testing, cleaning and painting the motors before returning them to stock.

It can be seen, then, that the acceptance of a trial offer nets a profit of approximately 10 per cent on the motor sale, while the refusal of an offer, if the motors are returned to the manufacturer, would result in a loss of 10 per cent on the motor sale, the amount paid as interest, and in addition, that part of the wiring cost which could not be recovered. This loss, however, is more apparent than real, because it was anticipated that in the event an installation was rejected, the company would exercise its option in purchasing the motors. These motors would then be used in future trials, and the loss would thereby be turned to gain. Moreover, we must also consider the additional profit received from the energy sold during the trial period. It is evident that there is little possibility of a loss in this plan, unless an unusual number of installations are rejected.

The plan as above given was used in Cincinnati about two years ago and resulted in remarkable success. It was offered only for a short time because the rapid increase in the use of central-station service became so generally known that it was thought advisable to discontinue the trial proposition. During the three or four months that it was offered, 12 installations, varying in size from 50 to 300 horsepower were made and not one was lost. As a matter of fact the customers in most cases were surprised to find that the actual energy consumption and cost would come so close to the amounts originally estimated.

Accuracy in this respect can be expected only from salesmen who have a good knowledge of isolated-plant operation. This knowledge may be obtained from observation, operating experience, or from the technical school, but it must be acquired in some way before the power salesman can hope to make any marked success.

Fertile Advertising Suggestions for Central Stations Offered.

The most effective mediums of advertising appliance sales by central stations were the subject of an interesting discussion at one of the sessions of the New England Section, N. E. L. A., Question Box, Convention at Boston, March 7 and 8.

C. R. Hayes, Fitchburg Gas & Electric Light Company, pointed out that it is well to use all good local newspapers, discriminating between those best suited to appliance advertising and those which should be used for other kinds of publicity. He called attention to the fact that to be really effective, all publicity matter must be followed up by live aggressive sales efforts.

Willard Hall, chairman of the Section's publicity committee, considered street-car advertising and billboards the kinds of publicity of least value, pointing out that in either case only the boldest announcement of the wares offered can be presented to the eye of the reader. Electrical appliances require detailed explanation, owing to the general unfamiliarity with their use. Hence lantern slides, newspaper advertisements, and window displays of the objects themselves are the most fruitful means of reaching buyers.

A representative of the General Electric Company said that 5,000 dealers had been queried by the advertising department, with the result that a large majority specified newspaper advertising as the most fruitful type of publicity, window displays and folders coming next in order of favor.

R. W. Rollins, general manager of the Worcester (Mass) Electric Light Company, said that occasions of reduction in rates are opportune for inclosing folders with light and power bills. The natural effect of a lower prospective lighting bill is to stimulate the purchase of some object of household convenience, with the result that the company is in a fair way to recoup itself from the added business it thus acquires.

St. Louis Company Gives Free Instruction in Electric Cooking.

A free cooking school has been instituted by The Electric Company, St. Louis, Mo., as announced in its advertisement, copy of which appears below. It will be noted from

A Free Cooking School
For St. Louis Domestics

Madam, Send Your Cook—We'll Pay Her $7.50 for Her Time

The Electric Company has now arranged to teach "Better Cooking."

Lessons will be given in the form of lectures, with demonstrations. Equipment has been provided so that those attending the classes actually can cook the various dishes, under an expert's direct supervision.

To each St. Louis cook, domestic or maid who takes the complete course of 10 lectures we will pay $7.50 for her time in attending the school.

That means $7.50 for a few odd hours on different days.

If you are a mistress, it is to your advantage to urge your domestic to attend. You are privileged to come yourself if you like.

If you are in some family's employ, don't miss this opportunity to develop your talents for cooking. Hundreds will enroll and earn this money. Resolve right now to be among the first.

WHY WE MAKE THIS UNUSUAL OFFER

Cooking electrically is today accepted in 3000 cities as the superior method of preparing food. We want all those employed in St. Louis kitchens to know more about it.

We want them to learn how easy, how simple it is to use an electric range. We want you to see how it saves you work and how much more delicious it makes the meals.

Hundreds of electric ranges are in daily use in St. Louis. More are being installed each week. To be valuable nowadays a cook must be up-to-date

This Expert Will Teach You —Enroll NOW!

Mrs. Margaret M. Williams Winn, the domestic science authority until recently in charge of the St. Louis School of Housekeeping, with her corps of trained assistants, will conduct our Cooking School. She will cook many foods in many ways. And she will use only an electric range.

The school starts March 14—but don't wait for that. Thousands will want to take this course and earn $7.50. You must let us know before the classes are all-filled. Come, write or telephone NOW and give us your name.

Electricity is Cheap in St. Louis

The Electric Company

UNION ELECTRIC: Main Office:—12th and Locust

The Terms Are These:

1. Course of 10 lectures conducted by Margaret M. Williams Winn
2. We pay $7.50 cash to those attending ten lectures.
3. A diploma signed by Mrs. Winn will be given at the completion of the course to those who acquire the required degree of efficiency.
4. The names of those who prove to be the best cooks and are given diplomas will be kept on file. This enables us to supply the names of our graduates when, as often happens, we are called upon by those seeking a competent domestic. The company, however, will not act as an employment bureau.
5. The school will be held on the tenth floor of the Union Electric Building, Twelfth and Locust streets.
6. Classes are limited to 25 persons. When all the classes are filled no more can enter.
7. White caps and aprons will be furnished free of charge to all who attend.

How the Electric Company Made Announcement of Its Free Cooking School.

this copy that not only are the instructions—to be given by Mrs. Margaret M. Williams Winn, domestic science expert—free to those who enroll, but besides, The Electric Company agrees to pay $7.50 in cash to each of those who complete the course of 10 lectures.

In addition to offering a strong inducement to housewives to increase the efficiency of their cooks by educating them in the principles of electric cooking, the cooks who wish to improve their time on their own accord, have every opportunity of so doing under The Electric Company's plan. Diplomas will be presented to those who develop to be the best cooks and their names will be kept on file for the benefit of the cooks themselves as well as for those who inquire for their services.

Rockford Electric Company Inaugurates Electric-Range Campaign.

The Rockford (Ill.) Electric Company is the latest addition to the rapidly growing list of central-station companies believing in the future of electric cooking. An electric-range campaign was actively inaugurated last month and already 20 installations have been made. "Cook by Wire Without Fire" is the slogan adopted and according to Wilbur Giffen, commercial manager of the company, one of the most satisfactory phases of the situation in Rockford is the fact that the local gas company, for the first time in many years, has started using newspaper space to advertise gas cooking.

The efforts extended in Rockford have as yet been preliminary to a strenuous campaign which will reach its "peak" during the summer months when cooking by gas or coal fire becomes an actual hardship. Accurate data are being obtained on every installation and no efforts spared to develop each customer into a booster for electric cooking. Realizing the importance of maintaining voltage, the Rockford Electric Company installs larger transformers wherein necessary and otherwise insures proper service.

One of the most important features of the campaign is the realization that customers must in most instances be instructed in the use of the electric range. An experienced demonstrater is employed for this purpose who devotes her spare time to securing prospects. Periodic visits are made to all range customers and advice given or suggestions made that will improve the value of the service.

Ranges are sold at a price that includes the cost of installation and the customer is permitted to pay in installments if desired.

The campaign to introduce electric cooking in Rockford had an auspicious beginning. The medium was an electrical household show, which was held for a full week during the latter part of February. One of the local furniture companies, having a building of its own in the center of the city, furnished the space on its ground floor free of charge to the exhibitors.

It was the policy to have the exhibition include everything for the furnishing of a modern home, and only one company was represented from each line. Twenty-five exhibitors were secured, representing everything in the household from pianos, heating systems, sewing machines, wall paper and draperies to electrical fixtures and appliances.

An association was formed to handle the financial side of the exhibit, and sufficient revenue was secured from the rental of the space to provide for all carpenter work installing booths, general decorating, lighting and other expenses, which included concerts every afternoon and evening. The feature of the show was the model kitchen of the Rockford Electric Company, where electric ranges were demonstrated by expert demonstraters. One kind of cooking was featured for each day of the week, and considerable publicity given in the newspapers in advance.

Double-page advertisements were run in the local newspapers with a total of six issues during the week. Each exhibitor contracted for his proportion of the space, and two columns were given over to writeups of the show

Exhibit of Rockford Electric Company's Model Kitchen at a Local Exhibition which Inaugurated the Company's Electric-Range Campaign.—There are now 20 Ranges Installed in Rockford.

without further charge. In every issue there was some writeup regarding the electric cooking, and in one issue the entire two columns were given over to the benefits of cooking electrically.

A large 80-foot sign was hung on the side of the building and was flood-lighted by three 500-watt projectors. In addition to this 20 500-candlepower nitrogen lamps were strung along the walk leading to the exhibition building. The building is so situated that the blaze of light could be seen for blocks and created considerable comment for the exposition.

One of the best means of publicity was received from the placing of signs on the front of street cars. Signs were also attached to the meter department trucks.

One of the very important results was the installation of an electric range in the domestic-science department of the local high school.

Actual attendance was recorded, and it was found that over 10,000 people witnessed the show. The expense to the company was surprisingly small for the benefits derived.

A great many live range prospects were developed and general publicity secured for the electric cooking, as well as other things electrical.

Electrical Shoe-Machine Heating Shown to Be a Success.

The substitution of electricity as the means of heating shoe machines, in place of gas, steam or other forms of heat, is going forward in the progressive shoe factories of eastern Massachusetts. One of the aggressive central stations in this respect is the Edison Electric Illuminating Company of Brockton. D. M. De Bard, of this company, is an active enthusiast in shoe-machine heating. While there are some factors that make the general substitution of electricity slow, one of them being the expense of exchanging electrically equipped machines for those of the older type, the field is considered alluring and worthy of any central station having shoe factories in its territory going after the business.

The following figures were recently compiled by Mr. De Bard as showing the economical characteristic of electric heating. In a plant at Brockton in which about 15,000 pairs of shoes are made monthly, the average amount of energy consumed by 13 shoe machines that have heating attachments was, for the months of July to February last, about 17 kilowatt-hours per 100 pairs. Detailed figures for four typical months are appended. It is to be noted that during July, August, September and a part of October no boiler was operated for steam heating, which would be necessitated were the machines heated by high-pressure steam, which is the more antiquated practice.

SHOE-MACHINE HEATING AT BROCKTON, MASS.

	July, 1916		Sept., 1916		Dec., 1916		Feb., 1917	
Machines	Kwh.	Kwh. per 100 pr.	Kwh.	Kwh. per 100 pr.	Kwh.	Kwh. per 100 pr.	Kwh.	Kwh. per 100 pr.
2 Stitchers	312	2.1	341	2.1	265	2.03	495	3.55
2 Welters	217	1.6	240	1.4	144	1.1	191	1.37
2 Pull-overs	543	3.5	615	3.7	20	.15	183	1.3
4 Box toe mach.	620	4.2	707	4.3	502	3.85	643	4.6
1 Bottom drier	640	4.3	610	3.7	366	2.8	637	4.57
1 Bottom filler	171	1.2	179	1.1	125	.96	175	1.25
1 insole mach	76	.5	149	.9	53	.4	130	.93
	2,570	17.4	2,841	17.2	1,475	11.30	2,454	17.57
No. pairs made	14,821		16,465		13,039		13,920	

Milwaukee to Use Electric Signs to Boost City.—Electric signs will play a big part in Milwaukee city booster campaign, recently launched by the Milwaukee Forward League, organized by the business men and civic associations for the purpose of spreading the fame of the Wisconsin metropolis. Big electric signs on downtown buildings and on factories along the railways will flash the Milwaukee message. F. T. Andrae, of the Julius Andrae & Sons Company, is chairman of the league's committee on electric signs.

Results of America's Electrical Week Compiled in Permanent Record Form.

The Society for Electrical Development, under whose auspices was conducted the second national electrical week, known as "America's Electrical Week," from December 2 to 9, 1916, has published a very well illustrated 64-page book entitled "A $3,000,000,000 Industry Pulls Together." The book has as a cover design the famous Aladdin poster of America's Electrical Week. It gives a carefully prepared summary of the activities carried on in various cities throughout the country during the week and gives actual concrete results that were derived therefrom. These are classified so that it is possible to determine how effective the various plans were. The first section covers educational and co-operative successes; other sections deal with results where demonstration and not sales was the object, combination sales and demonstration shows, street and building lights and decorations, increase of flood lighting, novel and effective window displays, special exhibits by firms or central stations and a general summary of many celebrations. Special mention is made of the co-operative effort made by the manufacturers of electrically driven musical instruments, also of the advertising and publicity results in newspapers.

Near the close of the booklet the new house-wiring campaign to be carried on from April 1 to May 15 is mentioned. Respecting the holding of another electrical week similar to Electrical Prosperity Week in 1915 and America's Electrical Week in 1916, no decision has yet been reached, but the Society is asking all its members to vote upon the matter. Two propositions are submitted, (1) for holding another electrical week during 1917, possibly similar to the national electrical weeks already found so successful; (2) postponing the holding of another national electrical week until the spring of 1918 and centering the efforts this fall into a "Buy Electrical Christmas Gifts" campaign.

New Power Installations at Boston.

Among the contracts for miscellaneous power and lighting service from the Boston Edison Company is the United States Hotel, which has abandoned its private generating plant, consisting of two 62-kilowatt direct-connected direct-current engine-driven dynamos, together with boilers, pumps and auxiliary steam apparatus, and substituted central-station electric service throughout. It is estimated that $2,000 will be saved annually, providing the hotel management carries out the Edison company's recommendations in the matter of motor drive and superfluous labor.

The Heywood Brothers & Wakefield Company, Somerville, will install about 45 horsepower in motors and install electric lighting in a factory building recently purchased. A portion of the building which is sublet to the American Woolen Company will have 150 horsepower in motors and eight kilowatts in lighting. This factory, as formerly operated, relied on a 150-horsepower steam plant, with 50-kilowatt generator.

Profit Sharing Enlists Employees' Best Efforts.

The issuance of employees' stock, and the payment of a salary bonus, are two effective means of tieing in the interests of employees of central stations, according to speakers at a recent convention of electrical interests at Boston.

R. W. Rollins, of the Worcester (Mass.) Electric Light Company, said that during the past five years to 1916 employees had received 2.5-per-cent bonus on their salaries, while last year they received five per cent. Mr. Riddell, of the Greenfield and Turners Falls companies, spoke of the excellent results accruing from the holding by employees of an issue of stock specially designed for them. Since the movement started, a marked improvement in their interest in the work of the company has been noted. The stock is sold at par and draws six per cent.

ELECTRICAL CONSTRUCTION

A Department Devoted to Problems Relating to the Installation, Operation and Maintenance of Electrical Equipment

Do Not Trifle with Low-Pressure Alternating-Current Circuits—Open the Service Switch First.

By John L. Gleason.

The truth of the old adage, "Familiarity breeds contempt," was forcibly impressed on my mind a few days ago by a "wallop" from an alternating-current circuit. For the past 25 years most of my work has been on alternating current and we always test for "life" at bare terminals with the thumb and forefinger. On 220 volts the sensation is quite pronounced but on 110 we often moisten the tips of the fingers to make sure the "juice" is there, so that the pressure of either voltage seemed negligible, and not to be feared.

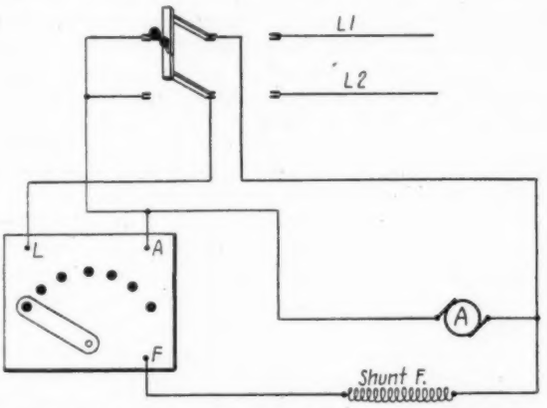
I had been called by a customer who could get no light from a "combination" pendant, so I tested the circuit with a magneto between fixture and the cutout and found that one of the legs was "dead." Piercing a small hole with a gimlet up at the outlet, I located its position on the floor above. The boarding was matched hardwood, so I took an old carving knife and cut down through the tongues so that I got up two of the boards undamaged, from a threshold to their ends. The boards were three inches wide so that I had only six inches of space to work in, but I could see a part of the circuit I wished to tap. Getting down on my knees I thrust my hands into the "pocket" as far as the wrists. Holding the wire with my left hand I commenced to skin the insulation with a jack knife in my right hand. The moment the blade touched the copper it seemed as though a giant slammed me against the floor, and no matter how I struggled I couldn't let go. The way the juice surged through my arms and body made me think I was up against a backing up of primary current. I saw visions of a wooden overcoat and orphan children and I was afraid, too, that my assistant might get hold of me and get "his." He is a young, husky, overgrown, and he did get hold of me, because he though I was in a fit, and thus broke the contact. The man of the house, hearing my scream, came rushing up and wanted to send for a doctor, but I told him that as long as I was alive then I would probably keep on but that he might bring up some alcohol to bathe the cuts on the head, nose and wrists; and a little brandy to steady the nerves. He brought both and expressed his sorrow that he had the job done, but I told him I was glad it happened for it was an excellent lesson at a low price. After washing up I put the brandy where it would do the most good and finished up the job, but you bet I opened up the service switch first.

On investigating the cause of the shock I found that the gas pipe that fed the "combination" pendant was notched into the floor timbers, and ran parallel to the boards I had taken up, but I didn't notice it at the time. My left wrist was smack up against this pipe while I held the wire with the left hand and, of course, the pipe was common with the grounded secondary, while the wire I was tapping was of the opposite polarity. I don't know how many volts I got but I never could have got loose if I had been alone, and the marks I have from the mixup will remind me to have more respect for low pressures.

Simple Dynamic Brake for Motor.

By L. F. Henry.

In the issue of March 10 there appeared an article on this subject by James D. Lynett. In my opinion the scheme shown in the accompanying diagram is simpler and better than Mr. Lynett's in that the danger of restarting the motor with the armature short-circuited is eliminated and only one double-pole switch is used. Moreover, only one operation is required to stop the motor, namely, that of throwing the switch from L1, L2 or "on" to "off"

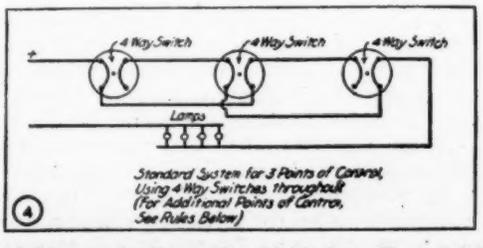


Simplified Wiring for Dynamic Brake for Shunt Motor.

position. Should this produce too abrupt a stop or cause serious heating of the armature, a pause may be made with the switch in open position. If the motor is large and even this pause is insufficient to avoid considerable heating when the switch is thrown to short-circuit position, it may be desirable to put a resistance between the left-hand contacts of the switch instead of a "dead short."

Wiring for Controlling Lamps from Two or More Positions.

An article on this subject was published in our last issue (March 17) accompanied by 11 illustrations of wiring schemes by both the standard and Carter systems for control from two, three or more positions, including master or "burglar-chaser" control. It has been pointed out to us by Ralph Proctor, of Indianapolis, Ind., and later by other readers, that there is an error in the connections of the right-hand four-way switch shown in Fig. 4 on page 455. In the accompanying diagram is shown the correct connection. It is suggested to readers that they correct the original Fig. 4, which was reproduced exactly as it appeared in the bulletin from which the diagrams were made. With this correction reference can be made to this valuable set of diagrams without error.


4 Way Switch
4 Way Switch
4 Way Switch
Lamps
Standard System for 3 Points of Control, Using 4 Way Switches throughout (For Additional Points of Control, See Rules Below)
4

Corrected Diagram for Controlling Lights from Three Points with Four-Way Switches.

The Development of Carbon Brushes

Relation of Carbon-Brush Development to Past and Future Development of the Electrical Industry—Recent Progress Toward Standardization of Brush Sizes

By E. H. MARTINDALE
Chairman, Industrial and Domestic Power Committee, A. I. E. E.

This is the first of a series of fourteen articles dealing with the solution of commutator and brush troubles. These articles will appear at intervals of two weeks and will be of a practical character so as to be of immediate benefit to the operators of all electrical machinery of the commutator type, particularly direct-current motors. The author is one of the best known authorities on carbon brushes.

IN THIS series of articles the author proposes to cover the operation of brushes in such a way as to enable electricians to locate machine troubles and to secure the best results from the machines. Many of the later articles will refer to some of the earlier ones and it is suggested that the series be kept at hand for reference.

In 1831, Faraday discovered that an electric current is momentarily produced in a coil of wire when a magnet is pushed into the opening of the coil, and that a current in the opposite direction is produced when the magnet is withdrawn. He soon after discovered that when a coil was placed in a magnetic field and a current passed through the coil, it tended to move out of the magnetic field. This is the fundamental principle of the motor. The discovery that a wire moved across a magnetic field produced an electromotive force, or in a closed coil produced an electric current, soon followed. As a north and a south pole were necessary to complete the magnetic circuit, the coil developed an electromotive force in one direction when passing under the north pole and in the opposite direction when passing under the south pole.

Before these discoveries were made, electrical energy had been produced by primary cells which gave direct current. No use had been discovered for alternating current. The commutator was therefore developed to reverse the connection to the outside circuit at the instant that the generated voltage in the coil reverses and thus it became possible to deliver a direct current. The first brushes used on these commutators were solid bars of copper and these were later replaced by brushes made up of thin strips of copper.

Important Influence of Carbon-Brush Development.

The earliest record the author has found of carbon being used for this purpose, is in a patent taken out in 1885, by Prof. G. Forbes, in which he suggested its use but did not actually apply it. From the time that carbon brushes were really tried the development of direct-current machinery and with it the development of the entire electrical industry, went forward by leaps and bounds.

It is not to be supposed that the lack of carbon brushes or material of similar characteristics would have delayed very much the development of such a wonderful industry, but it is probable that the development would have been more along the alternating-current line and correspondingly less along the direct-current.

For many years the art of making brushes received very little careful engineering study and almost any carbon or graphite that could be obtained was considered satisfactory. When the manufacturers of motors and generators began to increase the speed of motors and generators, in order to obtain more power from the same amount of iron and copper, the brush manufacturers found the old grades would not meet the requirements.

Special laboratories for designing and testing new grades of brushes were established by one carbon manufacturer in this country about 15 years ago. The next five years resulted in the development of a few new brushes, but the greatest benefit derived from that early study was a knowledge of the effects of different materials on the characteristics of brushes and the effect of brush characteristics on the operation of motors and generators.

Improvements in and Intelligent Selection of Carbon Brushes.

The last 10 years, and particularly the last four years have seen the development of many new grades of carbon, graphite and metal-graphite brushes. No manufacturer of brushes can be successful today without well appointed laboratories for the selection of standard materials, as well as for the manufacture and testing of new grades.

The motor and generator manufacturers are depending more and more on the carbon manufacturer's brush engineers to recommend the best brushes for their machines. The electrical engineers of big manufacturing plants and public utilities, no longer try to pick out their own brushes, but allow the brush engineers to specify the most economical grade for each machine.

There never has been, and it is safe to say there never will be, a universal brush. To be sure, there are brushes which will give fair satisfaction on nearly all machines, but the characteristics of different machines vary so greatly that the most economical operation is secured by the use of the brush best adapted to those characteristics.

The most progressive manufacturers of brushes now have data sheets on which the purchaser can give the characteristics of his machines, and when this information is given the manufacturer will supply brushes with the understanding that if they do not operate satisfactorily they may be returned for full credit. Such offers could not be made unless the manufacturer knew his brush engineers could make the guarantee good.

Without the improvements in carbon brushes, the present development in direct-current machines would have been impossible. The 60-cycle, 500-volt rotary converter, the direct-current turbogenerator, and other high-speed direct-current generators and motors would be unknown.

Undercut commutators with their great saving in maintenance charges would be impracticable with the brushes manufactured 15 years ago.

Definite limits to the energy which can be secured from a given amount of copper and iron assembled in a dynamo-electric machine are determined by tensile strength of materials and internal temperature rises. In commutating machines a further limitation is set by the allowable voltage between commutator bars and the number of bars which can be used within the limit of peripheral speed, set by the strength of materials and the economical construction of commutators for very high speeds.

In some 60-cycle, 600-volt, and 25-cycle, 1,500-volt rotary converters these limits have apparently been closely approached. The general line of large machines, however, has not been developed to any such extent. The additional cost of such construction is not economical except in large machines. The carbon manufacturers have shown them-

STANDARD SIZES FOR CARBON BRUSHES.

1.—Length of Round and Rectangular Brushes.

Up to and including 1¼ inches....increase by steps of ⅛ inch
Over 1¼ and to 3 inches.....increase by steps of ¼ inch
Over 3 inches.....increase by steps of ½ inch

Preference to be given steps of ¼ inch below 1 inch length and ½ inch above 1 inch length.

2.—Width and Diameters.

Up to and including ¼ inch.....increase by steps of $\frac{1}{16}$ inch
Over ¼ inch to 2½ inches.....increase by steps of ⅛ inch
Over 2½ inches.....increase by steps of ¼ inch

It is recommended that ¼-inch steps be used wherever possible. Diameters of round brushes shall vary by steps of $\frac{1}{16}$ inch.

3.—Thickness.

Up to and including ¾ inch.....increase by steps of $\frac{1}{16}$ inch
Over ¾ inch.....increase by steps of ⅛ inch

It is recommended that ⅛-inch steps be used wherever possible above ½-inch thickness.

4.—Limits.

Rectangular and Square Brushes.

Length.....plus or minus $\frac{1}{32}$ inch
Width.....exact size down to $\frac{1}{64}$ inch undersize
Thickness—Plain brushes.....plus 0.001 inch
minus 0.003 inch
Plated brushes.....plus 0.001 inch
minus 0.004 inch

For square brushes thickness limits to apply to both the width and thickness.

Round Brushes.

Diameter—
Up to and incl. ¼ in.....exact size to 0.006 inch undersize
$\frac{5}{16}$ and ⅜ inch.....exact size to 0.008 inch undersize
$\frac{7}{16}$-inch and above.....exact size to 0.010 inch undersize
Length.....plus or minus $\frac{1}{32}$ inch

Box gauges to be used for thickness and diameter.

5.—Length of Shunts.

It was decided that no standard lengths could be used, but it was agreed to define the length of a shunt as the distance from the top of the brush to the center of the slot or hole in the terminal.

6.—Holes or Slots in Shunt Terminals.

It was decided that exact sizes are not essential, but that the following shall be adopted as a maximum for the screws specified, and the minimum shall allow sufficient clearance to permit the screw entering the slot or hole without binding.

No. 8 and No. 10 screws.....$\frac{7}{32}$-inch hole or slot
No. 12 and No. 14 screws.....¼-inch hole or slot
$\frac{5}{16}$-inch screw.....$\frac{11}{32}$-inch hole or slot
⅜-inch screw.....$\frac{13}{32}$-inch hole or slot

7.—Bevels.

Bevels on carbon brushes shall vary by steps of 5 degrees and shall be accurate to within 1 degree above or below.

The length of a beveled brush shall be the distance from the end to the toe of the bevel, if beveled on one end only, or the distance from toe to toe measured parallel to the face of the brush when both ends are beveled. In other words, the length will be that of the square-ended brush from which the beveled brush was made.

8.—Plated Brushes.

Dimensions, limits, etc., to be the same as for plain brushes, except thickness limits, for which see Paragraph 4.

selves able to meet the needs of the designers and have thus contributed in a very large degree to this development.

Standardization of Carbon Brushes.

During all this time, no standards had been adopted to apply to the sizes of carbon brushes. Whatever efforts had been made in this direction met with no success. The carbon manufacturers therefore found the manufacture of their finished product handicapped by a multitude of sizes and grades.

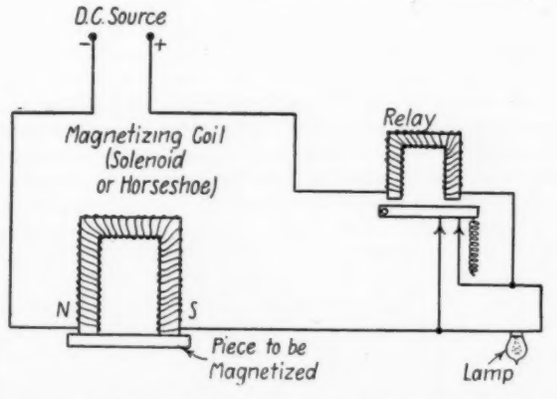
In the fall of 1914, the author, through his connection with the Industrial Power Committee of the American Institute of Electrical Engineers, started a careful investigation of the subject, and in May, 1915, turned his results over to the Electric Power Club, where his efforts met the most hearty co-operation. At first, such standardization seemed an almost hopeless task, but after nearly two years of earnest work on the part of the Electric Power Club and consultation with the Carbon Section of the Associated Manufacturers of Electrical Supplies, the adjoining standards have been adopted to apply to all machines, except railway motors. These same standards will be presented to the American Electric Railway Engineering Association at an early date for their consideration.

The Electric Power Club is to be congratulated on this excellent work.

Arrangement for Magnetizing Steel Effectively.

By George A. Broder.

The usual method of magnetizing a piece of steel that is used in small establishments or in the repair shops has been found by me to be very slow and to give in many cases a non-permanent magnet. I have found that by using what amounts to an interrupter it is possible to produce much more rapidly and more effectively a strong permanent magnet. The idea is that, instead of having the magnetizing solenoid or electromagnet coil produce a continuous flux through the piece of steel to be magnetized, it is much better to interrupt the current in the magnetizing coil and thereby the flux produced by it, this interruption occurring at regular intervals so as to produce what amounts to a jumping or pounding effect so that the molecules of the



Arrangement of Relay to Provide Interrupted Magnetizing Current.

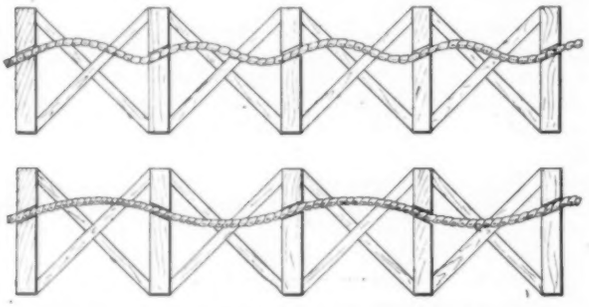
piece of steel are more readily arranged in magnetized order and therefore the piece of steel more quickly and permanently converted into a strong magnet.

The scheme consists in connecting a relay in series with the magnetizing coil, as shown in the accompanying sketch, which shows that the armature of this relay would intermittently open and close a shunt around a lamp. This lamp serves in place of a condenser to reduce sparking when opening the shunt circuit and allows the current to be reduced to a low value instead of having the circuit entirely broken.

USEFUL WIRING HINTS

A collection of some short-cut or otherwise valuable suggestions which, though not entirely new, are not as well known by wiremen as they deserve to be. Most of these suggestions have been submitted for publication as "Dollar Wiring Kinks," which department is intended for new and original ideas only and will reappear soon.

Installing Flexible Armored Cable and Conduit.—When installing flexible steel-armored cable and conduit (BX and Greenfield) both in new and old buildings, we had trouble in pulling these through the joists when the holes in the latter had been bored all in one direction as shown in the upper

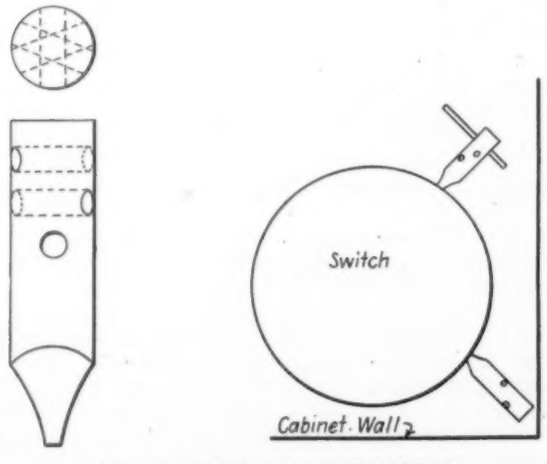


Difficult and Easy Installation of Armored Cable or Conduit.

sketch. It occurred to us that by boring the holes as shown in the lower sketch there would be only half as many bends. The result was gratifying because both the Greenfield and later the snake and wires could be drawn into place much more expeditiously than formerly. Charles Rubner.

Soldering Lugs on Large Cables Without Harm to Braid.—A good way to solder terminal lugs on heavy conductors without harm to the braiding is to first wind three or four layers of friction type on the edge of the insulation. When heat is applied to the end of the conductor the unprotected braiding usually loosens, but if tape is first put over the braid and left in place until the lug has cooled completely, it will be found on removing the tape that the braiding is in perfect condition. J. H. Lamoureux.

Handy Screw Driver for Close Quarters.—A handy little screw driver for getting into corners where the ordinary screw driver cannot be used is made as follows: Take a one-inch length of five-sixteenths-inch steel or iron rod and grind to fit the slot in screws. Then drill three holes in different positions 60 degrees apart so that the driver may be turned by using brads shoved into the holes. I find this most useful in setting up the screws in switches placed near the walls of cabinets, etc. Arthur S. Nickerson.



Handy Screw Driver for Confined Work.

To Run Neutral Solid Through Three-Wire Cutout.—To run the neutral wire of a three-wire subfeeder or three-wire branch on any three-wire grounded-neutral system solid through an ordinary triple-pole branch cutout of the Edison plug type, remove the mica or fiber washer at the bottom of the neutral-wire screw shell and replace it by a brass washer. This short-circuits the cutout very easily and neatly.

M. W. Jones.

Removing Porcelain Knobs Without Breaking.—In removing old knobs, especially tie knobs, if a piece of pipe is used of such size that will just fit over the knob, they can be removed quickly and easily without breakage. The pipe is put all the way over the knob and then pulled toward the operator. This causes the knob to come off and fall into the pipe. The operation may then be repeated at other knobs until the entire pipe is full. This is a very quick and safe way to remove knobs.

O. L. Grosser.

Among the Contractors.

Nelson & Brown, contractors, Portland, Ore., have been awarded the contract for lighting equipment for the interstate bridge and its approaches. The amount of the contract is $4,289.

The United Electric Construction Company, 1727 Sansom Street, Philadelphia, has been awarded a contract for electrical equipment in the new Jacksonville (Fla.) railroad terminal, at a cost of $15,000.

K. D. Slocum, of Clinton, Iowa, has disposed of his electrical contracting business to the A. D. Baker Electric Company, which will conduct the business as formerly with the addition of an electrical engineering department.

The Watson Electrical Company, 27 Thames Street, New York City, has acquired property on Mechanic Street, Newark, N. J., for a new branch establishment as New Jersey headquarters. New branches will also be located at Elizabeth, Trenton, Camden, Atlantic City, Paterson and Hoboken.

The Electrical Equipment Company, incorporated with a capital of $100,000, will open business in Butte, Mont., on May 1. A. von Dachenhausen, for 11 years commercial agent for the Montana Power Company, will be president and general manager of the new concern, and Michael Sullivan, formerly of the Sullivan Electrical Company, will be in charge of the construction department.

The electrical contracting firm of Lee Goldstein of DuBois, Pa., has been particularly successful in obtaining important contracts for installations in the immediate future. Among these are the following: The Brockway Machine Bottle Company, Brockwayville, Pa., will electrify its entire plant for which purpose a large generating unit, consisting of steam engine and generator, has been procured from the Ridgway Dynamo & Engine Company; the entire plant will be motor-driven and all of the equipment will be installed by Mr. Goldstein's firm. The DuBois Brewing Company is electrifying its brewery and replacing all belt drives by direct-connected motors. The Van Tassel Tanning Company, also of DuBois, Pa., is electrifying its tannery and all of the machinery will be driven by motors. All of these motors will be installed by the contracting firm mentioned.

VIEWS AND COMMENTS

A Reader's Page Wherein Opinions on Topics of General Interest to the Electrical Industry May Be Expressed

Careless Estimating and Its Evils Due Largely to Ignorance of Costs.

To the Editor:

Ignorance of cost is, in the writer's estimate, responsible for the deplorable conditions found in many instances in the electrical contracting business at present. This fact is forcibly brought out wherever jobs are let by bids. When we see the variation in these bids, we cannot blame the owner or architect for wondering what is wrong with the bidders. The situation leaves them to form any conjecture they may chance on, the usual one being that all the bids over a certain one are based on an exorbitant profit. Under present conditions, it follows that if the owners will reject the bids enough times and get the job figured over, they will eventually get the job done not only below the actual net cost of the material and labor, but in many cases the bidder will donate, in ignorance that he is doing it, quite a nice percentage of the amount of the bid, which donation is often not even thankfully received by the owner or whoever lets the job.

We are just now bidding on a job on which the bids have been rejected three times, but we are going to save our pencil and paper this trip. Doubtless there will be no scarcity of bidders, as there were several bidders each time bids were taken. This is nothing more nor less than "horse-play" and as long as the bidders will bid just so long will the owner "jockey" around with his job. The writer knows positively that the amount of the net profit on this job, that is the sum which would represent the net profit if the job were taken at a correct figure, has long since been spent by the various bidders in trying to get this job. This seems positively foolish and wasteful. We don't buy butter and eggs that way; these items are the same standard price almost everywhere because they are marketed under a different system. Why should not electrical work bring the seller a standard and just price to net him a reasonable profit based on a scientific knowledge of cost of production instead of the buyer's shrewdness, as it is at present?

The unit system at present seems to be the most accurate method of estimating cost of labor. The quantity of material is comparatively easy to determine in advance, while the cost of labor is the item on which there is apt to be a wide variation. By the unit system we simply base the cost on the fact that it costs more to run ten feet of conduit than it does four feet. It has been proven that work cannot be figured by the outlet within any reasonable degree of accuracy to cover all classes of buildings encountered in the course of business. As soon as the cost can be set for carrying on any operation per unit under various conditions, then we have something definite to start with. By keeping a reasonably accurate record of the cost as it actually runs during the progress of the work, this method can be checked up and thus used to formulate a definite set of prices which can be safely used. I want to lay stress on the importance of keeping these costs during the progress of the work, as the many conditions arising while the work is under way are then noted and taken into consideration, which would not be the case if these items were not checked up until the job were completed; often work runs along over a considerable period and many items would be lost sight of if not noted during the progress of the work.

It appears that many contractors get so busy with the minor details of their work that they let the larger problems get by unnoticed. It is well, therefore, to ever keep these important items in mind and let close scrutiny and investigation become a habit of one's daily work so as to become familiar with costs in every detail and thus eliminate the chance of error. Let us hope for the day when every bidder on a job will know to a certainty that he has included all the items in that job, has estimated his labor accurately and finally has added a profit which he knew would really net him a profit and then "stand or fall" by his bid, and let us earn the respect of the owner who will then not wonder what is wrong with the electrical business.

Ed. M. Raetz,
Member of Firm, Foster-Raetz Electric Company.
Rochester, Minn.

Hazards of Home-Made Devices.

To the Editor:

In your issue of January 27, 1917, we note an item on a home-made bed warmer, which is of interest to us. We wish to protest against the publication of such articles on account of the fire hazards it carries with it. A home-made bed warmer, such as the one illustrated and described, placed in a bed is very apt to cause fire. We know of instances where lamps have been placed in beds to warm them and trouble resulted therefrom. We believe that the publication of such home-made devices encourages their use. Such devices should be submitted to the Underwriters' Laboratories for test before they are recommended for use.

Our experience along the lines of fire prevention prompts us to write you in this regard, and we trust you will appreciate our position in the matter.

Charles E. Eldridge,
Manager, Kansas Inspection and Fire Prevention Office.
Topeka, Kans.

Dynamic Braking of Motor.

To the Editor:

In the issue of March 10 I note a wiring scheme proposed by Mr. James D. Lynett for obtaining a rapid stopping of a shunt motor by means of dynamic braking. This scheme has been used quite extensively, but requires some caution. I would advise inserting resistance in the armature circuit when the double-throw switch is thrown to the braking position, that is, when the armature is short-circuited. If the motor is of considerable size, the moving mass of the armature running at full speed at the time of applying the dynamic brake requires considerable energy to bring it to a stop in a short time. By means of the dynamic brake all this energy is transformed into heat and all of this heat, except a very small amount dissipated in the motor leads, must be spent in heating the armature of the motor, since no regulator for the brake was shown in the circuit. It is my belief that a large motor, operated in the manner indicated, would not last very long if this method of braking without resistance in the armature short-circuit was applied very frequently.

B. Berssenbrugge,
Milwaukee, Wis. *Electrical Inspector, City of Milwaukee.*

Railroad Electrification in Wisconsin.—A bill has been introduced in the Legislature of Wisconsin by R. H. Bradley, of Superior, Wis. It provides that railroad corporations should have, in addition to their present powers, the right to use electricity in lieu of steam as motive power. It also permits partial substitution of electricity for steam under direction of the Wisconsin Railroad Commission.

NEW APPLIANCES

A Review of the Latest Developments and Information Respecting Electrical and Kindred Mechanical Appliances

New Cord Connectors.

About three years ago the firm of Harvey Hubbell, Incorporated, Bridgeport, Conn., put on the market a line of three-wire wiring devices which met a considerable demand for use with such appliances as require three-wire circuits and also where it is desired to ground the case or cover of the device. To this line there has now been added a durable 10-ampere cord connector which will be found useful in linking up permanently installed wall or flush receptacles with portable machines, appliances and laboratory apparatus arranged for three-wire work. The composition cap of

Three-Wire Cord Connector

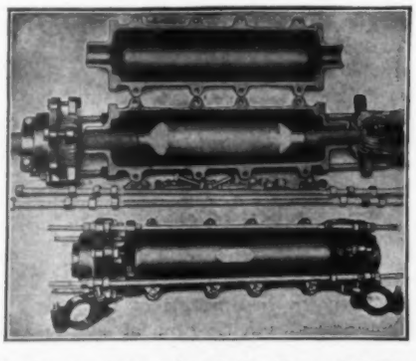
Two-Wire Cord Connector

this new connector is interchangeable with all the three-wire attachment plug bases, wall receptacles and flush receptacles of the Hubbell type.

The firm has also added a small composition cord connector of the two-wire type which is believed to meet the demand for a compact and inconspicuous connector of durable construction to be used in connection with the Hubbell line of interchangeable attachment plugs and receptacles both of the wall and flush types. The cap of this new connector is interchangeable with both polarized and non-polarized receptacles and also the line of small attachment plugs manufactured by the Hubbell organization.

Improved Joint Box for Submarine Cable.

In placing electric cables in underground conduits or in laying them on the bottom of a body of water, frequent joints are necessary and there are apt to be weak spots both electrically and mechanically unless these joints are properly made and protected. A new and improved type of joint box or housing for use on submarine cables has recently been developed and perfected by the Standard



Joint Box for Submarine Cable, Open and Closed.

Underground Cable Company, Pittsburgh, Pa. It has been used successfully on submarine cables supplied to the Atlantic City Electric Company for the United States Ship Canal, at Atlantic City, and the Wilmington & Philadelphia Traction Company and Pennsgrove Light, Heat & Power Company for crossing the Delaware River, at Wilmington, Del. It was also used in Canada on submarine cables of the Halifax Electric Tramway Company and the City of Ottawa Water Works Department.

This joint box is so designed that all mechanical stresses resulting from the action of tides, currents, etc., that usually tend to damage the cable at these points are taken off the joint proper by long "take-up" rods on the joint box parallel to the cable, and transmitted to the steel wire armor on each side of the joint and to which armor the rods are rigidly connected by heavy iron clamps. This construction will be made clear by reference to the illustration.

As submarine cables, even under normal conditions, are subjected to severe mechanical stresses and have heretofore often failed first at the joints, this new device, which so far has proven very effective, offers a solution for a serious problem in submarine cable laying.

Two New Improvements for Hotpoint Electric Flatirons.

Cord breakage in electric irons has been a source of much worry to consumers, dealers, and manufacturers, and has really come to be considered as almost an incurable malady. Numerous remedies have been prescribed, tried, and found ineffective, but as usual, perseverance has triumphed. The development

Hinge Joint for Flatiron Cord.

department of the Hotpoint Electric Heating Company, Ontario, Cal., has now brought out a hinged cord-protector switch plug which eliminates cord breakage and the many other ills to which previous style plugs were heir.

The general construction of the plug and path of the cord as it leads into the plug is as follows: The cord first passes through a smooth composition bushing at the upper end of a spiral spring which prevents chafing at that point. It continues through the double spiral spring, the ends of which are securely fastened to the slide hinge joint at the upper part of the metal plug cap. The spiral spring supports the cord and prevents sharp bendings or kinks in the cord that are most common near the plug. The hinge joint still further relieves the cord by adding flexibility. The spring will not interfere with the arm of operator.

The composition plug bar forms an anchor for the cord, which is wrapped around it in a way to relieve all possible strain from the copper conductor and where it is fastened to the binding screws. The increased length of cord necessitated by the loop around the plug bar prevents heat reaching the point at which actual bending occurs which further adds to the life of the conductor. Both ends of the plug bar are rounded, affording a firm grip for the thumb and forefinger when pulling the plug from receptacle.

In fastening the conductor to binding screws, all fine wires are neatly and compactly inclosed in a metal cup washer also serving as a nut-lock. This eliminates all cause for short-circuit at the binding screws. Contact springs are of high-grade spring steel, tempered so that heat at the contact parts will not affect them. They are improved by being slotted, giving a four-point contact and assuring excellent, knife-switch connection, firmly gripping the terminals without rendering the plug difficult to remove; they release their hold with a smooth, sliding motion, which prevents arcing with its consequent terminal, plug and cord troubles. The contact springs are incased between the recessed composition plug halves, which are formed to give greatest strength and eliminate danger of short-circuit. They are securely fastened together by two screws. Through this construction the plug will remain cool at all times.

Thumb Rest for Flatiron Handle.

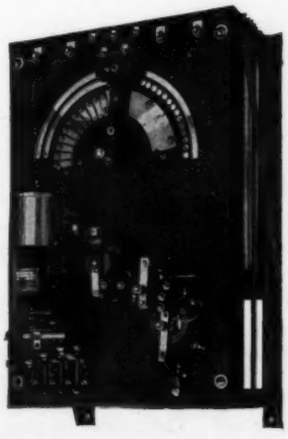
Another improvement which will be much appreciated by the housewife is the Hotpoint thumb rest. Placing the thumb on this rest at intervals during the ironing relieves the wrist and makes ironing easier.

New Printing-Press Controllers.

The Industrial Controller Company, Milwaukee, Wis., has recently developed a new and complete line of automatic controllers designed particularly for printing-press service.

The illustration herewith shows one of the several automatic printing-press controllers brought out by the company. This controller consists of an automatic starting movement of the same construction as the type E, largely used for different industrial purposes, and a hand-set speed regulator mounted on the same panel with the automatic movement.

The speed regulation of the motor is accomplished by moving a lever to any position desired. Speed below normal is obtained by inserting resistance in the armature circuit of the motor, and speed above normal by inserting resistance in the shunt field.



Automatic Printing-Press Controller.

The standard controllers are designed for 40 per cent speed reduction and 100 per cent. speed increase. Full field strength during starting is secured by means of a vibrating field relay mounted on the panel. A dynamic brake is also provided for rapid stopping of the press.

The controllers designed for wall mounting have the automatic starting mechanism at the top, and the speed-regulating lever below, which arrangement permits the controller to be mounted fairly high, still giving easy access to the starting lever.

The speed-regulating lever may be set to give any desired speed to the press. Push buttons mounted on, or near, the press are used to stop and start the motor, always bringing it up to the predetermined speed at which the regulating lever has been set. The time of acceleration is adjustable by means of needle valves in the dashpot of the automatic movement.

Lockout Push-Button Station for Printing-Press Control.

There may be used with this controller any of the numerous types of standard industrial controller push buttons. By these buttons the press may be started, stopped, inched, run at extra slow speed for make-ready, or reversed.

Several stations are often furnished for each press and buttons are also supplied with a lockout feature so that when the press is stopped at one station and locked out, it cannot be started from any other station until the lockout button is released.

Decimal and Computed Split-Hand Motion-Study Watch.

The instrument illustrated has recently been brought out by Mortimer J. Silberberg, 122 South Michigan Avenue, Chicago, Ill., and is believed to be a decided improvement on all previous time-study watches and stop watches, inasmuch as a decimal and computed dial has been combined with a high-grade split-hand watch.

Improved Motion-Study Stop Watch.

A split-hand watch with a decimal and computed dial has become a necessity, as time and motion study has been steadily advancing and our industries have been demanding a greater refinement of the original single-hand instruments, in order to keep pace with the more complicated motion problems which are constantly arising.

The large dial of this watch is a decimal dial, divided into tenths and hundredths of a minute, and also contains figures spaced two hundredths of a minute apart, indicating at any point of elapsed time exactly what the corresponding hourly production would be. This feature is identical with the time-study watch, which was the original instrument placed upon the market.

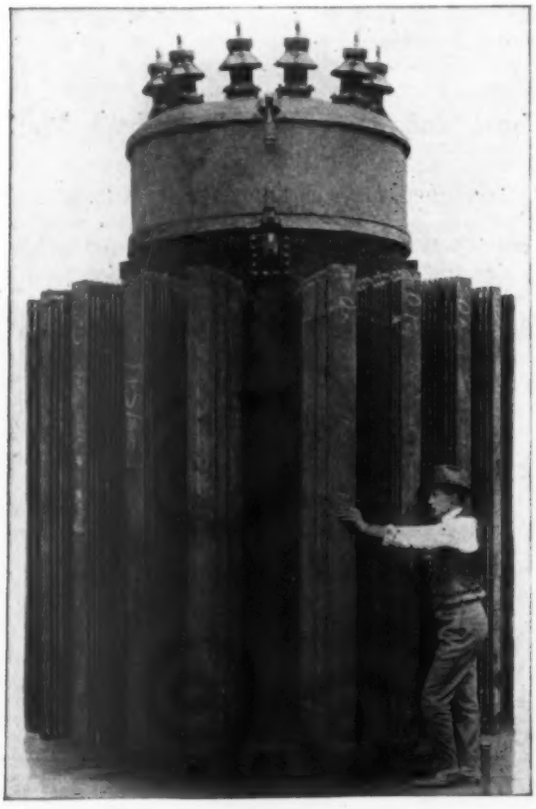
The combination of this dial, however, with a split-hand watch, constitutes an improvement which will greatly facilitate time and motion study, in that at one observation both the productive and non-productive time of an operation can be obtained, whereas, heretofore, on the single-hand instruments two readings were necessary to obtain this result.

The computations on the dial denote pieces or operations per hour. The small inset dial denotes minutes up to 30.

This watch embodies two hands, one of which is controlled by the side plug and the other by the crown, or if it is desired to use both as a unit, both hands may be controlled by the crown. The crown-controlled hand may be used to determine the gross time, and the plug-controlled hand, to take out the non-productive time or delays, thereby at one reading giving an observer both the gross and net time of an operation.

Largest Feeder-Voltage Regulator Yet Built.

While we may not have the human giants of old with us, their places are admirably filled by the gigantic mechanical and electrical apparatus that modern genius has evolved, as for instance, the device shown in the accompanying illustration. This shows the largest self-controlled induction feeder-voltage regulator that has ever been built.



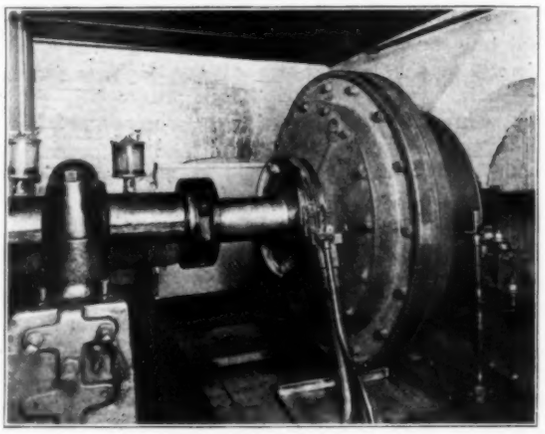
Automatic and Self-Cooling Feeder-Voltage Regulator.

This regulator, which is of the oil-insulated, self-cooling type, was made by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. It is rated at 600 kilovolt-amperes, three-phase, 60 cycles, 12,200 volts, with 10 and 20 per cent regulation at 262 and 131 amperes. It is designed for operation outdoors with full automatic control self-contained.

This regulator was built for the Southern Power Company and is to be connected to the low-voltage side of a 6,000-kilovolt-ampere bank of 44,000 to 13,200-volt transformers on the power company's line at Spray, N. C. By the use of this regulator the power from the line will be delivered to the Thread Mill Company mills owned by the Marshall Field interests of Chicago, with the voltage maintained continuously at normal value.

Magnetic Clutch-Brake Used On Overhead Calender Drive.

In the accompanying illustration a rather unusual installation of a large magnetic clutch-brake is shown. This equipment is in the Passaic, N. J., plant of the New York Belting



Magnetic Clutch-Brake on Shaft About 10 Feet Above Floor.

& Packing Company, and was furnished by the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis. The shaft to which this magnetic clutch is applied is approximately 10 feet from the floor, the view showing a clearance of only a few feet from the ceiling. The brake magnet which cannot be seen is back of the clutch and is mounted on an I-beam frame built especially for that purpose. Eight calenders are driven from this overhead shaft, all protected by the magnetic clutch-brake equipment. The simplicity and compactness of this type of cutoff made possible an installation of this kind in the small space available. Current is carried to the slip rings of the clutch through the conduit shown strapped to the brush support near the center of the picture. The magnetic clutch is made up essentially of just two parts, a driving member and a driven member. The driving member carries the magnetizing winding. Either or both of the members, depending on the size of the clutch, are mounted on spring steel plates which normally hold the friction faces out of engagement, but which yield sufficiently when the magnetizing coil is energized to permit them to come into the frictional engagement necessary for the transmission of power. The armature and steel members are carried on the outer circumferences of annular spring steel plates which are mounted on the clutch hubs.

Normally, the driving and driven members are held out of contact by the spring plates, but when the current is applied to the winding of the field member, they are magnetically drawn together, the flexibility of the steel plates allowing the movement to take place. The power is then transmitted entirely by frictional engagement between the two members.

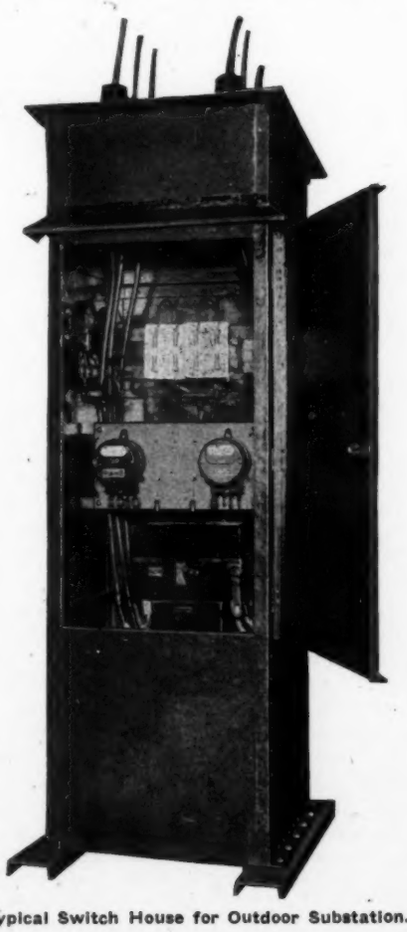
Switch Houses for Outdoor Substations.

The problem of properly housing and protecting switching equipments is one of considerable importance in installations which supply electric power to small towns, manufacturing plants, mines, etc., where the load is not large enough to warrant the expense of a substation with indoor apparatus. For outdoor distributing substations of this character, portable switch houses, such as are shown in the accompanying illustration, have been found to give such satisfactory service that the tendency is toward an increase in their application as well as in their size and capacity.

Standard switch houses built by the large electrical manufacturing concerns are in general of two forms—ground-mounting and pole-mounting. They are constructed of steel throughout and are provided with a large door that gives easy access to the interior and that can be locked, thus protecting the apparatus from tampering by unauthorized persons. These houses are usually designed to contain an oil circuit-breaker, a watt-hour meter with current transformers and potential transformers, besides calibrating and testing terminals and the usual wiring.

The chief features that make this type of switch house particularly suitable for the purpose are their cheapness and the fact that they are portable and can be readily conveyed to localities where needed. Small plants that otherwise could not be reached, due to the high cost of substation construction, can thus be readily supplied from transmission lines. These houses are absolutely weatherproof and all apparatus is fully protected from the elements.

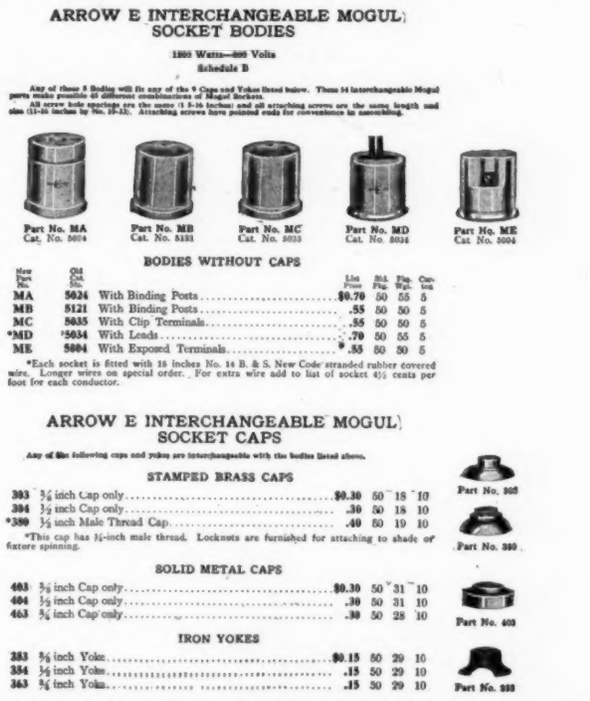
The standard products are built in capacities up to 600 amperes at 7,500 volts, both single-phase and polyphase. The usual dimensions of such houses are 3 by 3 by 10 feet high, although some special houses are being built in much larger sizes. The general trend in switch-house construction is shown by the fact that a contract has recently been taken by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., for a house 10 by 10 by 10 feet high for an installation of 4,000 kilovolt-amperes at 13,200 volts, three phase, 60 cycles.



Typical Switch House for Outdoor Substation.

Arrow Interchangeable Mogul Sockets.

Recent development of wiring devices has been along the lines of standardization and interchangeability. As a natural result there has developed the stocking and selling of various types of sockets and switches under the part system (unassembled). At the present time, brass shell sockets, electrolier sockets, porcelain shell sockets, standard attachment plugs, pull switches, and a number of other types of wiring devices, are sold under this so-called part system.



ARROW E INTERCHANGEABLE MOGUL SOCKET BODIES

1500 Watts—600 Volts

Schedule B

Any of these 5 Bodies will fit any of the 9 Caps and Yokes listed below. These 14 interchangeable Mogul parts make possible 45 different combinations of Mogul Sockets.

All screw hole spacings are the same (1 5-16 inches) and all attaching screws are the same length and size (11-16 inches by No. 10-32). Attaching screws have pointed ends for convenience in assembling.

Part No. MA Cat. No. 5004 | Part No. MB Cat. No. 5121 | Part No. MC Cat. No. 5035 | Part No. MD Cat. No. 5034 | Part No. ME Cat. No. 5004

BODIES WITHOUT CAPS

New Part No.	Old Cat. No.		List Price	Std. Pkg.	Exp. Wgt.	Cu. In.
MA	5024	With Binding Posts	$0.70	50	55	5
MB	5121	With Binding Posts	.55	50	50	5
MC	5035	With Clip Terminals	.55	50	50	5
*MD	*5034	With Leads	.70	50	55	5
ME	5004	With Exposed Terminals	.55	50	50	5

*Each socket is fitted with 18 inches No. 14 B. & S. New Code stranded rubber covered wire. Longer wires on special order. For extra wire add to list of socket 4½ cents per foot for each conductor.

ARROW E INTERCHANGEABLE MOGUL SOCKET CAPS

Any of the following caps and yokes are interchangeable with the bodies listed above.

STAMPED BRASS CAPS

303	⅜ inch Cap only	$0.30	50	18	10
304	½ inch Cap only	.30	50	18	10
*380	½ inch Male Thread Cap	.40	50	19	10

*This cap has ½-inch male thread. Locknuts are furnished for attaching to shade or fixture spinning.

Part No. 303 | Part No. 380

SOLID METAL CAPS

403	⅜ inch Cap only	$0.30	50	31	10
404	½ inch Cap only	.30	50	31	10
463	¾ inch Cap only	.30	50	28	10

Part No. 403

IRON YOKES

353	⅜ inch Yoke	$0.15	50	29	10
354	½ inch Yoke	.15	50	29	10
363	¾ inch Yoke	.15	50	29	10

Part No. 353

Portion of Catalog Page, Showing Interchangeability of Mogul Sockets.

Following this tendency, the Arrow Electric Company, Hartford, Conn., has developed its complete line of porcelain mogul sockets, so that it is now made up of interchangeable units.

There are five bodies interchangeable with nine caps. All screw-hole spacings are the same ($1\frac{5}{16}$ inches), and all attaching screws are the same length and size (11/16 inch by No. 10-32). Attaching screws have pointed ends for convenience in assembling.

These 14 interchangeable parts make possible 45 different combinations, which cover all the present types sold assembled and a number of additional types.

This makes it possible to meet practically any requirement needed in actual practice. It will reduce the number of pieces to be carried in stock room from 3 to 1, and the investment from 7 to 1.

To purchase a standard package of each of these 45 devices would represent an investment of $1,960 list, and a stock of 2,250 pieces. To purchase a standard package of each of the 14 parts, by means of which any of the 45 sockets could be made up, would represent an investment of only $270 list, and a stock of 700 pieces.

The parts are neatly packed 5 bodies to the carton, and 10 caps to the carton. The standard package is 50 in all cases. The list price of the integral parts equals the list price of the complete or assembled devices.

ACTIVITIES IN THE TRADE

American Electrical Heater Company, Detroit, Mich., has issued price list No. 33, giving revised prices on its line of electric heating appliances.

Duncan Electric Manufacturing Company, Lafayette, Ind., has prepared a 24-page booklet on direct-current watt-hour meters for light and power service. Besides describing and illustrating the Duncan lines, many good points are given about the selection and care of meters.

Manhattan Electrical Supply Company, with headquarters in New York City, has closed a long-term lease for a five-story building, containing 90,000 square feet of floor space, at Fourteenth and Papin Streets, St. Louis, Mo. The building will be used as a branch office and for factory purposes.

American Electric Tool Company recently held a meeting of stockholders at Petersburg, Va. A new board of directors was elected and it was determined to manufacture and push the sale of the new Paulero electric hammer The officers of the company are as follows: President I. G. Shore; vice-president, B. Mason Hill; secretary and treasurer, David A. Lyon, Jr.; general manager, Louis Paulero.

Automobile Headlights.—At the meeting of the Metropolitan Section of the Society of Automobile Engineers held in New York City on March 15, an important paper was presented by Alden L. McMurtry on the subject "Headlamp Design as Affecting Glare Reduction." This paper pointed out the very serious and objectionable glare commonly produced by ordinary automobile headlights and suggested how it may be minimized by proper design of the headlamp equipment. The meeting was very largely attended.

New Jersey Public Utility Tax Becomes a Law.—Governor Edge, of New Jersey, has signed the Oliphant Bill, which establishes an increased tax on electric, gas and water utilities operating in the state. The law, which exempts all companies from its provisions with gross receipts of less than $50,000 a year, provides an additional assessment of one per cent on the present tax of two per cent immediately, with increase to four per cent of gross receipts in 1918, and a maximum of five per cent in 1919. The increased revenue from the tax is estimated at a total of $1,000,000, and for the principal cities as follows: Newark, $270,000; Jersey City, $100,000; Paterson, $50,000; Camden, $25,000; Trenton, $25,000; Elizabeth, $30,000, and Passaic, $15,000.

Crocker-Wheeler Company Prosperous.—The February statement of the Crocker-Wheeler Company, Ampere, N. J., electrical machine manufacturer, shows an increase in surplus of about seven per cent, bringing the total surplus to more than $850,000. The net earnings broke the record for February, a short month, being greater than in any February since the founding of the company 28 years ago. It is further stated that the bookings continued good and this represents straight electrical business, as the company, after completing several highly profitable munition contracts, has returned to the exclusive manufacture of electrical equipment. However, it has been announced that the company stood ready to re-enter the munition business if called upon by the United States Government, as it has, in addition to the equipment, the trained men necessary for the work. The common stock of the company continues on a permanent eight per cent annum basis, with the preferred yielding seven per cent.

The Industrial Controller Company, Milwaukee, Wis., has recently issued a new complete catalog devoted to the subject of automatic control equipment for printing presses. Special features pointed out are the possibility of setting the speed to any point within a very wide range, and the possibility of controlling from push-button stations. Copies of this catalog will be sent to those interested in this subject upon request.

Barber-James-Dwinnell Electric & Manufacturing Company, Kansas City, Mo., has been reorganized and about April 1 will move its factory to Topeka, Kans. The company manufactures storage batteries and lighting plants and is now furnishing equipment of this type in practically every state west if the Mississippi River and also in Canada. The company also does a considerable electrical jobbing business both in wiring supplies and in electrical apparatus. The company experienced a very prosperous year in 1916 and from indications so far during 1917 it is very likely that this year will even exceed the record of last year. The company has never done any retail business and it expects to continue this policy. The main office at Topeka will be at 423-7 Jackson Avenue; the Kansas City office and warehouse will remain in its old location at 600 East 15th Street.

H. W. Eves has resigned his position as assistant manager of the Chicago office of the Hamilton-Beach Manufacturing Company, and has become Chicago manager for the Arnold Electric Company, of Racine, Wis. His office is in the Marquette Building, Chicago. He is also handling several other electrical specialties, among them a heating pad made by the Electric Controller Company, of Indianapolis, Ind., and a high-frequency violet-ray apparatus of the Sterling Corporation, Cleveland, O. The Arnold Electric Company is manufacturer of a line of vibrators, hair driers, drink mixers, the new Arnold electric motion sign, phonograph motors and other electrical devices. Mr. Eves has also resigned his position as secretary of the Consolidated Manufacturers Company, which he held about two years, and will devote himself entirely to the lines refered to above.

George C. Knott has resigned as sales and advertising manager of the Wirt Company, Philadelphia, and formed a partnership with **George L. Hatheway.** The new company will be known as Hatheway & Knott, with offices at 120 Liberty Street, New York, and will engage in the distribution of products of various electrical manufacturers. Mr. Knott was for many years associated with the Benjamin Electric Manufacturing Company and Mr. Hatheway was formerly with Pass & Seymour. Both are widely known in the United States and Canada. For the entire United States, they will act as general sales agents for the well known line of R. M. C. conduit fittings, etc., and Eade chain insulators; in New York and eastern territory, the Wirt Dim-a-lites, Killark Electric Manufacturing Company's products and others. They will also maintain a Canadian connection, representing throughout the Dominion the following concerns: Manhattan Electrical Supply Company, Steel City Electric Company, Killark Electric Manufacturing Company, Capital Porcelain Manufacturing Company, Eastern Flexible Conduit Company and National Electric Porcelain Company. Correspondence is solicited by the new firm with manufacturers desiring a general sales representation in the United States and Canada.

PERSONAL AND BIOGRAPHICAL

MR. B. F. LYONS, who was elected president of the Wisconsin Electrical Association at its ninth annual convention in Milwaukee, March 14 and 15, enjoys the unique distinction of having also been elected president of the Wisconsin Gas Association at its annual convention held in Milwaukee just preceding the electrical convention. This is the first time in the history of either organization that the same man has occupied both positions. Mr. Lyons, although a young man, has for a number of years been one of the most active members of the Wisconsin Electrical Association and has held numerous important offices. During the past two years he held the offices of second and third vice-president respectively. Mr. Lyons is a graduate of the University of Wisconsin and has had considerable experience in the public utility field. He

B. F. Lyons

was first connected with the Laclede Gas Company of St. Louis, Mo., as assistant engineer, occupying this position for about three years. Later he became engineer for the Merchants Power Company, of Memphis, Tenn., remaining in this capacity until his appointment as vice-president and general manager of the Beloit (Wis.) Water, Gas & Electric Company, which position he now occupies. Mr. Lyons is an active member of the National Electric Light Association, of the Jovian Order and many other organizations.

MR. C. K. BEEKMAN and MR. H. J. PRICHARD were elected at the annual meeting to fill vacancies in the board of directors of the American Cities Company, a subsidiary of the United Gas & Electric Engineering Corporation, of New York City.

MR. J. W. GILLETTE, formerly connected with H. M. Byllesby & Company, of Chicago, and later with the Ft. Smith (Ark.) Light & Traction Company, has been appointed manager of electric-lighting plant at Clarinda, Iowa, recently purchased by the Continental Gas & Electric Company, which owns and operates plants at Red Oak and Shenandoah, Iowa, and a number of Nebraska towns. Mr. Gillette spent several years in Australia, where he was connected with electrical enterprises.

MR. CYRUS PIERCE has resigned as director of the Northern California Power Company.

MR. WALTER COAKLEY, formerly plant superintendent of the Toledo (O.) Railways & Light Company, and recently on temporary detail at the Niagara Light, Heat & Power Company, Tonawanda, N. Y., has been appointed general superintendent of the Knoxville Gas Company, operated by Henry L. Doherty & Company.

MR. E. C. BRADLEY, director and a former vice-president of the Pacific Telephone & Telegraph Company, San Francisco, Cal., has been appointed assistant to the Secretary of the Interior, Washington, D. C. Mr. Bradley was vice-president of the Postal Telegraph-Cable Company, New York, for ten years previous to his entering the telephone service at San Francisco in 1907.

MR. ERNEST F. LEARNED, of Watertown, Mass., has become associated with the Day Baker Motor Truck Company, of Boston, as sales agent for the Hunt industrial electric truck, which has lately been placed on the market. Mr. Learned is a graduate of the Massachusetts Institute of Technology and was for a number of years in the engineering department of Stone & Webster, occupied chiefly in hydroelectric and railway work.

MR. JOHN D. BALL, of the consulting engineering department of the General Electric Company, and assistant to DR. CHARLES P. STEINMETZ, has severed his connection with the company where he has been engaged for the last ten years, and has accepted the appointment of professor of electrical engineering in the School of Engineering of Milwaukee, Milwaukee, Wis. Mr. Ball is a graduate of the University of Illinois and a member of the American Institute of Electrical Engineers.

MR. A. C. JORDAN, for some time past in charge of the power end of the commercial department of the Cumberland County Power & Light Company, Portland, Me., will succeed MR. GEORGE T. FISHER, commercial manager, who resigned to accept a position in New York City. Mr. Jordan is a native of Cape Cod, Mass., a graduate of the Massachusetts Institute of Technology, and has had experience in the Westinghouse plant, Pittsburgh, and with the power department of the Elmira, N. Y., central-station company.

OBITUARY.

MR. H. C. CHAPPEL, who for about eight years was the Ohio representative of the Manhattan Electrical Supply Company, died at his former home, Defiance, O., on March 12. Mr. Chappel made his headquarters at Toledo, O., traveling from there throughout the state. He was one of the best known and most active electrical men in Ohio and nearby states. He was especially active in the Jovian Order, of which he was one of the statesmen-at-large. Mr. Chappel was 54 years of age. He is survived by his widow.

MR. C. A. TINKER, aged 79, for many years previous to 1902 when he retired from active service as general superintendent of the eastern division of the Western Union Telegraph Company, died at Winnipeg, Man., March 12. Mr. Tinker was one of the best known telegraph officials in the country. He was one of the "sacred three" telegraphers who were so closely associated with President Lincoln during the Civil War.

MR. FERDINAND W. ROEBLING, treasurer and general manager of John A. Roebling's Sons Company and a director in twenty or more other important companies, died March 16 at his home in Trenton, N. J., of heart disease. Mr. Roebling, who was 75 years old, was born in Saxonburg, Pa., the son of John A. Roebling, founder of the noted manufacturing and construction firm. He was educated in Polytechnic College, Phila-

F. W. Roebling.

delphia, where he specialized in chemistry. After graduation he entered business with his father, who designed the Brooklyn Bridge, but who died in 1869 before the structure was completed. The work was taken up by Washington A. Roebling, the older son, and Ferdinand, who finished the construction of the bridge 14 years later. In addition to his connection with John A. Roebling's Sons Company, Ferdinand W. Roebling was president of the Trenton Brass & Manufacturing Company and the Union Mills Paper Manufacturing Company, and an influential director in a number of electric light and railway companies and banking institutions. During the many years of his managership of the Roebling company he was known as a conscientious and thoroughly capable captain of industry, who was held in the highest esteem by his associates and who commanded the loyalty and affection of all his employees. His death is a severe loss to the manufacturing fraternity and to the house of Roebling, which occupies a strong and important industrial position. He was a member of the Union League and Engineers' Clubs of New York City. Mr. Roebling is survived by two sons—Karl G. and F. W., Jr.—two daughters, and three brothers—Charles G., Washington A. and Edward Roebling.

CURRENT ELECTRICAL NEWS

Weekly Record of Construction Activities

EASTERN STATES.

NEWPORT, ME.—This town has contracted with the Central Maine Power Company to light the streets and public buildings for five years at a price not to exceed $1,000 per year.

MONTPELIER, VT.—The Vermont & Quebec Power Corporation has filed articles of association. The capital stock is $500,000. The incorporators are Charles H. Thompson, Montpelier; Sheldon R. and Eva A. Boright, Richford, and Robert L. Ryder, Boston.

NEWPORT, VT.—The Newport Electric Light Company will soon begin the construction of a granite masonry dam 600 feet long and 20 feet high near Arnold's Mills. The estimated cost is $40,000. A penstock to the power house will give 137-foot lead. Nearly 1,000 horsepower will be developed.

DANA, MASS—Leon Bellamy, of Springfield, representing the Dodge Engineering & Construction Company, of Boston, is preparing plans for the rebuilding of the Soapstone electric power plant, recently destroyed by fire.

MARLBORO, MASS.—The City Council is considering the establishment of a white way in Main Street. John A. Curtis and others favor the plan.

TURNERS FALLS, MASS.—The Turners Falls Power & Electric Company has contracted with the Springfield Street Railway Company for the auxiliary supply of power, and new apparatus is to be installed to provide therefor.

HARTFORD, CONN—The name of the Haddam Electric Light Company has been changed to the Central Connecticut Light & Power Company by legal enactment.

WATERBURY, CONN.—The United Electric Light & Water Company's bill to increase its capital stock to $3,000,000 was unopposed at a recent hearing at Hartford.

NEW YORK, N. Y.—The American Telephone & Telegraph Company has announced that it will expend about $90,000,000 in improvements and extensions during the present year. A total of $66,000,000 was spent for similar work in 1916.

NEW YORK, N. Y.—The Sixth Avenue Association is perfecting plans for the installation of a street-lighting system along the thoroughfare. It is proposed to utilize the elevated railroad structure on the street in connection with the new lighting plans, and to install high-powered lamps with reflectors. J. Irvin Murray is chairman of the advisory board of the organization.

ST. GEORGE, STATEN ISLAND, N. Y.—The Richmond Light & Railroad Company and the Staten Island Midland Railway Company have made application to the Public Service Commission for permission to consolidate under the name of the Staten Island Light & Traction Company, Inc. The new company proposes to have a capital of $15,000,000 and requests permission to issue bonds for $1,350,000 for immediate operating use, including improvements and extensions.

HACKENSACK, N. J.—The Gas & Electric Company of Bergen County has been granted permission by the Board of Public Utility Commissioners to issue $500,000 bonds for improvements and extensions.

McAFEE, N. J.—The Bethlehem Steel Company, South Bethlehem, Pa., will install a new crushing plant and electric shovel equipment at its local limestone quarries. The proposed plant will be electrically operated and have a capacity of about 3,500 tons per day. The cost is estimated at $350,000.

TRENTON, N. J.—Plans have been completed for the installation of a lighting system in Mahlon Stacy Park. Commissioner Burk is in charge of the proposed improvement.

BLOOMSBURG, PA.—The Electric Bond & Share Company, 71 Broadway, New York, which recently acquired the Northern Central Company, operating a system of power stations and distributing lines in the vicinity, is planning extensive additions and improvements in the different properties, including the erection of a new power plant for mill and industrial works operation.

CHESTER, PA.—The Beacon Light Company, a subsidiary of the Philadelphia Electric Company, is taking bids for the erection of a five-story, steel and concrete plant, about 200 by 400 feet. John T. Windrim, Philadelphia, is the architect.

ERIE, PA.—The Erie Lighting Company is having plans prepared for the erection of a new reinforced concrete power plant with equipment. Day & Zimmerman, Philadelphia, are the architects.

HARRISBURG, PA.—The new creamery plant now being erected by the Hershey Creamery Company, 401 South Cameron Street, will be equipped for electric operation. The refrigerating plant to be installed will have a daily capacity of 135 tons, and ice-making plant 35 tons per day.

HARRISBURG, PA.—The Harrisburg Light & Power Company has commenced the installation of underground conduit systems to replace its overhead lines on a number of streets. The work is estimated to cost $50,000. The Pennsylvania Railroad will install an underground conduit system on North Seventh Street, replacing an overhead line section of about 150 poles.

HAZELTON, PA.—In connection with the extensions of its local repair shops, the Lehigh Valley Railroad is planning the establishment of electric plants for shop operations.

PHILADELPHIA, PA.—Charles Christos has filed plans for the erection of additions to his textile plant on Hunting Park Avenue including a new power plant.

PHILADELPHIA, PA.—The Bell Telephone Company has filed plans for the erection of a new central station at Fifty-seventh and Chestnut Streets to cost $170,000. The structure will be three stories about 140 by 215 feet. Irwin & Leighton, 126 North Twelfth Street, are the contractors.

PITTSBURGH, PA.—On March 11 fire destroyed the power house at the plant of the Westinghouse Machine Company, East Pittsburgh, with a loss estimated at $50,000.

POTTSVILLE, PA.—The Reading Railway is planning to electrify its system from Pottsville to Schuylkill Haven, and later to Reading, a total distance of 37 miles. The work, including equipment, is estimated to cost $750,000.

SINKING SPRING, PA.—The Krick Electric Company has been granted a charter to supply electric service in Spring Township. The capitalization is $10,000 and W. F. Krick, H. S. Dissler and G. J. Root are the directors.

AMBLER, MD.—The City Council has awarded a five-year contract for street lighting to the Ambler Electric Light, Heat & Motor Company.

FAIRMOUNT, W. VA.—The Fairmount Electric Service Company has been incorporated, with a capital of $10,000. James A. Knight is interested in the company.

SHINNSTON, W. VA.—The Shinnston Power & Light Company has been incorporated, with a capital of $15,000, by A. R. Wells, J. B. Wyantt and others.

LEXINGTON, N. C.—J. E. Foy and Dermot Shemwell of this city have incorporated a company, with $100,000 capital, to further develop waterpower on Musser Creek, near Columbia. The company plans to reconstruct the plant and build a dam. Contracts have been secured to furnish electricity to Columbia, Ashford and Headland.

DAVISBORO, GA.—Engineer W. M. Creek, Grant Building, Macon, Ga., is preparing estimates for electric-light and water systems.

EASTMAN, GA.—The property of the Eastman Electric Light Company has been sold to the banking firm of Marshall & Company, which, it is stated, contemplates extensive improvements to the local plant.

VALDOSTA, GA.—Application has been made for the incorporation of the South Georgia Power Company to operate hydro-electric plants and for other purposes. The capital stock is $25,000. Frank and William Roberts and associates, of Valdosta, and B. F. Rucker, Schenectady, N. Y., are the incorporators.

NEW PORT RICHEY, FLA.—The Council is planning to establish municipal light and water systems.

TAMPA, FLA.—The Tampa Electric Company has commenced work on additions to its plant which will cost about $400,000. A new 7,200-kilowatt turbogenerator will be installed in the company's Jackson Street power house.

NORTH CENTRAL STATES.

BLUFFTON, O.—The village has voted a bond issue of $35,000 for the purpose of paying for improvements to the electric and water plants. A modern lighting system will be installed. Bids will be called for soon.

CINCINNATI, O.—The Board of Education will receive bids until April 9 on the installation of a vacuum cleaning system in the Madisonville school buildings.

CLEVELAND, O.—The Cleveland Electric Illuminating Company has filed plans for a $35,000 substation, 50 by 49 feet, two stories, to be erected at 817 East 103d Street.

NELSONVILLE, O.—C. C. Sharp is at the head of a new company which will develop coal lands near Jacksonville and will open three mines which will be electrically operated. Energy will be furnished by the Hocking Power Company.

LAFAYETTE, IND.—Mayor Bauer is in favor of installing a municipal electric-lighting plant in connection with the city waterworks.

LAGRANGE, IND.—The C. F. Cain Water, Power & Light Company has been organized to supply electric light and power to Lagrange, Rome City, Ontario and Wolcottville. Its capital is $75,000. Power will be developed from Pigeon River.

NEW ALBANY, IND.—Considerable attention is being given by residents here to a suggestion of Charles A. Very, a local engineer, for construction of a canal from the Ohio River around the city, providing for a fall of six feet, which, it is declared, would provide power sufficient to run the city railways and an abundance more for manufacturing purposes.

NEW CASTLE, IND.—The New Castle electric-lighting system, which was damaged by fire, will be rebuilt.

ELKVILLE, ILL.—The Central Illinois Public Service Company, which has extensive interests in Southern Illinois, has purchased the electric-lighting system at Elkville. The plant will be abandoned and energy will be supplied from Carbondale, 13 miles south, as soon as a high tension line is completed between the two towns.

TISKILWA, ILL.—The Council is planning to establish an ornamental lighting system in Main Street.

TOULON, ILL.—The Toulon Light & Power Company has sold its plant to the Stark County Power Company of Wyoming, Ill. The latter company will erect a transmission line between the two plants.

SIDNAW, MICH.—Announcement has been made that the Northern Michigan Power Company, of New York and Sidnaw, will begin operations on its Sturgeon River development in April. The company proposes to build two large dams near the headwaters of the Sturgeon River and to create a head of water sufficient to develop 20,000 horsepower. The company was promoted by Walter S. Prickett, of Sidnaw. Several years ago a power line was surveyed from the site of the dams to Houghton.

AMERY, WIS.—The Inter-County Electric Company has been organized by E. J. Schneider and others to furnish electric service in this locality.

JUDA, WIS.—Estimates are being prepared for a local electric-lighting system.

MELLEN, WIS.—The Mellen Light & Water Company will purchase additional electric machinery. A. W. Pribow is general manager.

MONROE, WIS.—The city will install an ornamental lighting system for which bids will be advertised soon.

NEENAH, WIS.—Electric power probably will be installed at the pumping station of the Neenah waterworks.

PORTAGE, WIS.—The Council is planning to install an ornamental lighting system in the local business district.

RACINE, WIS.—The plant of the Racine Electric Power Company was destroyed by fire recently. The loss is estimated at $25,000.

RIPON, WIS.—The Ripon Light & Water Company contemplates building 100 miles of transmission lines from Portage to Beaver Dam this spring.

SHEBOYGAN, WIS.—The Eastern Wisconsin Electric Company has purchased a 7,500-horsepower steam turbine and auxiliary equipment at a cost of about $150,000.

STEVENS POINT, WIS.—The Jackson Milling Company, of this city, has submitted to the Railroad Commission plans for the erection of a new hydroelectric plant. It is reported that the concern plans to transmit power to its paper mill at Biron, Wis.

WHITEWATER, WIS.—The City Council contemplates rebuilding the local electric distributing system, at an estimated cost of $25,000.

ALGONA, MINN.——The City Council is discussing the question of investing $30,000 for additional generating equipment to be installed in the municipal plant, or purchasing power from the Commonwealth Utilities Company, which operates in this section.

ELGIN, MINN.—The Village Council has made arrangements for the installation of a white-way system.

FARIBAULT, MINN.—At a meeting of the City Council the City Engineer was instructed to prepare an estimate of the cost of a municipal electric-lighting plant, such as has been proposed in the petition recently filed with the Council.

HERON LAKE, MINN.—A franchise has been granted to the Northern States Power Company to furnish electric service. The same company also has secured franchises in Bingham Lake and Okabena.

LANCASTER, MINN.—The Council is planning to install an $8,000 electric-lighting system.

ANTHON, IOWA.—The city is planning an expenditure of $20,000 for an electric system.

CLARINDA, IOWA.—The Lee Light & Power Company has been sold to the Continental Gas & Electric Company, which owns and operates plants at Red Oak and Shenandoah, besides other plants in Nebraska.

FORT MADISON, IOWA.—Plans are being completed for the building of the Nauvoo-Fort Madison interurban system. Stock subscriptions amounting to $550,000 have been raised locally.

SHEFFIELD, IOWA.—The Cedar Valley Electric Company, of Charles City, has purchased the property of the Sheffield Light & Power Company, and is considering plans for improvements.

HIGBEE, MO.—The city of Higbee will have 24-hour electric light and power service from the Moberly Light & Power Company.

ST. LOUIS, MO.—J. J. Frey, president of the Southern Illinois Light & Power Company and the Saline Electric Company, has announced the purchase of the Citizens' Gas, Electric & Heating Company, of Mount Vernon, Ill., for $500,000.

BALDWIN, KANS.—At the April election Baldwin will vote on the issuing of $20,000 bonds for the rebuilding of the local electric light and water plant. The new plant will cost approximately $15,000.

CIMARRON, KANS.—The city is considering a proposition from Garden City for furnishing electrical energy for power and light.

IRVING, KANS.—Bonds in the sum of $7,000 probably will be voted for a distribution and lighting system here, and a transmission line to Blue Rapids.

LA CRESSE, KANS.—The city authorities of Bison are arranging with those of La Cresse for furnishing electric power and light.

LONG ISLAND, KANS.—The Phillipsburg Mill & Elevator Company, of this city, proposes to furnish electric service to Prairie View. About 25 miles of transmission line would be necessary.

DATES AHEAD.

National Association of Electrical Inspectors. Biennial convention, New York, March 27-29. Chairman of the committee on arrangements, Alfred E. Braddell, Sprague Electric Works, New York City.

Tri-State Water and Light Association of the Carolinas and Georgia. Annual convention, Macon, Ga., April 17-19. Secretary, W. F. Steiglitz, Columbia, S. C.

Southwestern Electrical and Gas Association. Annual convention, Dallas, Tex., April 26-28. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

National Fire Protection Association. Annual meeting, Washington, D. C., May 8-10. Secretary-treasurer, Franklin H. Wentworth, 87 Milk Street, Boston, Mass.

Arkansas Association of Public Utility Operators. Annual convention, Pine Bluff, May 16-18. Secretary-treasurer, R. B. Fowles, Pine Bluff Company, Pine Bluff, Ark.

Missouri Association of Public Utilities. Annual convention, aboard Steamer *Quincy* en route from St. Louis, May 17-19. Secretary, F. D. Beardslee, 315 North Twelfth Street, St. Louis, Mo.

Electrical Supply Jobbers' Associations. Semi-annual meeting, Homestead Hotel, Hot Springs, Va., May 22-24. Secretary, Franklin Overbagh, 411 South Clinton Street, Chicago, Ill.

Iowa Section, National Electric Light Association. Annual convention, Des Moines, Iowa, May 24-25. Secretary, L. E. Caldwell, Iowa City, Iowa.

National Electric Light Association. Annual convention, Atlantic City, N. J., May 29-June 1. Secretary, T. C. Martin, 29 West Thirty-ninth Street, New York City.

American Institute of Electrical Engineers. Annual convention, Hot Springs, Va., June 26-29. Secretary, F. L. Hutchinson, 33 West Thirty-ninth Street, New York City.

JOHNSON, NEB.—A bond issue of $15,000 will be voted upon, the proceeds to be used for electric-lighting and water systems.

LITCHFIELD, NEB.—Bonds amounting to $7,000 have been voted for the installation of a municipal electric-lighting plant.

PLAINVIEW, NEB.—Plans are being considered by O. N. Micheuer, city light commissioner, to extend the local electric service to the towns of Foster and Breslau. If this is done additional generating equipment will be installed in the local municipal plant.

CENTERVILLE, S. D.—The Centerville Milling Company contemplates installing new engine and boiler equipment and also a water wheel and generator. R. W. Nash is superintendent.

MARVIN, S. D.—An electric-lighting system will be installed here.

SOUTH CENTRAL STATES.

CAMPBELLSVILLE, KY.—Charles Walls and others have incorporated the Campbellsville Electric Light & Power Company with a capital of $40,000, to furnish electric service in this vicinity.

LEBANON, KY.—The Lebanon Lighting Company is contemplating the installation of a new generator.

PADUCAH, KY.—The city, through W. A. Gardner, commissioner of public property, will purchase two 300-kilowatt, 60-cycle, three-phase generators, direct connected to compound non-condensing engines. It will also purchase two 300-horsepower water-tube boilers.

TOMPKINSVILLE, KY.—The Tompkinsville Electric Light & Ice Company, J. B. Brown, manager, will rebuild the plant recently destroyed by fire.

JASPER, ALA.—The Jasper Water, Light & Power Company has been sold to Weakley & Fies, of Birmingham, who propose to develop and improve the property.

WETUMPKA, ALA.—The Montgomery (Ala.) Light & Water Power Company contemplates extending its transmission system to Wetumpka.

WINNSBORO, MISS.—O. E. White will install an electric light and power plant here.

GILLHAM, ARK.—The B. & A. Mining Company, of Okmulgee and Gillham, contemplates the construction of a hydroelectric plant.

OZARK, ARK.—The local electric-lighting plant has been sold by Bill & Dupriest for $20,000, to the Citizens' Service Company, of Davenport, Iowa, which now owns the systems in Alma, Altus, Coal Hill, Denning, Dyer, Mulberry, Ozark and Paris.

PARIS, ARK.—The city is having preliminary surveys made for the installation of an electric-lighting plant and waterworks. Winters & Dove, Fort Smith, Ark., are engineers.

CARMEN, OKLA.—The electric-lighting plant is to be remodeled and 24-hour service inaugurated.

CLAREMORE, OKLA.—The Commercial Club is undertaking the promotion of an electric railway system between Skiatook and Pryor, passing through the cities of Collinsville and Claremore.

COVINGTON, OKLA.—The Council is planning to establish a municipal electric-lighting plant.

COWETA, OKLA.—Estimates are being prepared for an electric-lighting system for this town.

GATE, OKLA.—A bond issue of $7,000 has been issued to provide for an electric-lighting system here.

FAXON, OKLA.—Bonds in the sum of $1,500 have been voted for an electric-lighting system here.

LAHOMA, OKLA.—The Enid Electric Light & Gas Company is considering a number of extensions to its distribution system.

ABILENE, TEX.—The American Public Service Company has sold its electric light and other public utilities plants located in a number of towns of Texas and Oklahoma to the Insull Syndicate, of Chicago. The plants involved are located at Abilene, Biard, Cisco, Jefferson, Longview and Marshall, Tex., and Hugo, Okmulgee and Henryetta, Okla. It is stated that the new owners will install additional machinery and make important improvements to a number of these plants.

BEAUMONT, TEX.—The white-way system has been ordered extended from Sixth to Eighth Street on Washington Street.

DENISON, TEX.—The Texas Power & Light Company will begin the construction of a large electric power plant five miles north of Denison, across the Red River, in Oklahoma, as soon as the Bureau of Indian Affairs gives its official sanction of the project. The Legislature of Oklahoma has already adopted a resolution giving authority on the part of the state for the construction of the plant. The new power station will cost about $750,000, and will be one of a series of similar plants which the Texas Power & Light Company has built as a part of its extensive transmission system. The same company is preparing to build a large power station at Austin.

SANDERSON, TEX.—Joseph Kerr has acquired the Sanderson waterworks and electric-lighting plant. It is understood that improvements will be made.

WICHITA FALLS, TEX.—It is proposed to install ornamental lights in the business district and later to extend the system.

WESTERN STATES.

LIVINGSTON, MONT.—The Council is planning to install an electric-lighting system.

MISSOULA, MONT.—The Northern Idaho Light & Power Company has applied for permission to extend its power and telephone line from Olson to St. Ignatius.

OSWEGO, MONT.—The Council will call an election to vote on the question of issuing bonds to provide for an electric-lighting system.

PUEBLO, COLO.—The Arkansas Valley Railway, Light & Power Company, of this city, has under construction an 11-mile extension of its 13,000-volt transmission line from Avondale, through the town of Boone, and following the Missouri Pacific railroad tracks to the Thatcher Cattle Company's big ranch.

CLOVIS, N. M.—The city is seeking the loan of $20,000 for use in making extensions to the municipal light and water plant.

GLOBE, ARIZ.—The International Smelting and the Inspiration Mining companies are making preparations for the installation of additional generating equipment in their power plant, which is owned jointly by the two companies.

SALT LAKE CITY, UTAH.—The County Commissioners are negotiating for the sale of the electric-lighting system owned by the county. Its value is about $15,000.

SALT LAKE CITY, UTAH.—The Utah

Power & Light Company has surveyors in the field laying out a route for a proposed addition to the transmission tower line between this city and Grace, Idaho. The improvement will add 50 per cent to the present capacity from that source of power. The distance is 130 miles and the extension will cost about $300,000. There is already sufficient generating plants at Grace to supply both the tower and the new pole lines, but the company plans increasing this generating plant later.

POCATELLO, IDAHO.—The City Council is investigating the question of installing a municipal electric-lighting plant.

TACOMA, WASH.—The city has made an appropriation of $17,000 for the purchase of two lighting feeder panels with equipment for installation in one of its substations.

KLAMATH FALLS, ORE.—The California-Oregon Power Company will put on a force of 300 men just as soon as weather conditions will permit, and will rush the construction of the dam across Ward Canyon on the Klamath River. The dam will be capable of developing 50,000 horsepower.

ROSEBURG, ORE.—Plans are under way for the installation of municipal electric-lighting and water systems with funds available from a bond issue of $250,000 already authorized.

ALAMEDA, CAL. — The Union Iron Works has been granted permission by the City Council to purchase electric power from an outside concern under the control of the Council and the Board of Electricity.

CRESCENT MILLS, CAL.—The Great Western Power Company has a force of 30 men putting up the transmission line which is to supply the Crescent Mining Company. For the present the current will be supplied by the plant at Butte Valley.

EUREKA, CAL.—Through the efforts of the Eureka Development Association, it is probable that an ornamental street-lighting system will soon be installed here.

HEMET, CAL.—The Southern Sierras Power Company will install an electric-lighting system along Florida Street in the vicinity of Valle Vista.

LOS ANGELES, CAL.—Bids have been called for by the Department of Public Service for 2,000 suspension insulator units.

LOS ANGELES, CAL.—City officials have asked for bids on the installation of an addition to the Verdugo Lighting District.

LOS ANGELES, CAL.—Bids have been called for by the city for the installation and maintenance of a street-lighting system for Fifty-fifth Street, between Budlong and Normandie Avenues.

LOS ANGELES, CAL.—Pursuant to its policy of acquiring additional waterpower sites for a surplus store of hydroelectric power, the city has filed application with the Department of the Interior and the State Water Commission for a power site on the Kern River. Development of the power site will cost $1,000,000, according to estimates compiled by the city. The estimated capacity is 20,000 horsepower.

PITTSBURG, CAL.—The Great Western Electric Chemical Company has let the contract for additions to the power house, etc., to the Foundation Company, of New York. Several hundred thousand dollars will be expended.

RIVERSIDE, CAL.—Work has been started on the underground electric light and telephone wires which will permit the removal of poles from Seventh Street, between Orange and Lemon Avenues. Poles will also be removed from portions of Eighth Street.

SAN FRANCISCO, CAL.—Petitions have been received by the Board of Supervisors asking for the formation of a lighting district at Vistacion Valley. An election will be held in the district, putting the matter to a vote.

SAN FRANCISCO, CAL.—The State Railroad Commission has issued a supplemental order to its recent decision, authorizing the Pacific Gas & Electric Company to buy certain properties of the Oro Electric Corporation. The supplement states that the Pacific Gas & Electric Company has filed satisfactory stipulations that it will not claim values for franchises obtained in this deal greater than their original cost, and that certain extensions and improvements to the system will be made.

VENTURA, CAL.—C. L. Christman has filed an application for approval of his intention to secure from the city of San Buenaventura a franchise to build and maintain an electric plant. The plant will be near Ventura.

WATTS, CAL.—The Board of Trustees has awarded the contract for the installation of a new electrolier lighting system along the east side of Fern Street, from the junction with Electric Boulevard, to Eagle Street and other streets, to T. H. Heinauer, at $61.25 per post.

YUBA CITY, CAL.—Citizens of the town of Meridian have petitioned the board of supervisors to form a Meridian lighting district.

Proposals

TELEPHONES.—Sealed proposals will be received at the office of the Chief Signal Officer, War Department, Washington, D. C., until April 2, for furnishing camp telephones and service buzzers. Further information may be had on application to the above-named office. Refer to Proposal No. 936.

ELECTRIC LOCOMOTIVE CRANES.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until April 9, for two electrically operated locomotive jib cranes of 50 gross tons capacity at the navy yards, Norfolk, Va., and Philadelphia, Pa. Plans and specifications may be had on application to the bureau or to the commandants of the navy yards named.

ELECTRIC TRAVELING CRANES.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until April 2, for furnishing and installing one 150-ton, two 15-ton, one 20-ton, and one 5-ton electric traveling cranes at the navy yard, Philadelphia, Pa. Drawings and specifications may be had on application to the bureau or to the commandant of the navy yard named.

ARMORED CABLE.—Sealed proposals will be received by the Commissioner of Gas and Electricity, Room 614 City Hall, Chicago, Ill., until March 26, for furnishing and delivering to the City of Chicago No. 6 B. & S. gauge 5,000-volt armored cable, strictly in accordance with the specifications on file in the office of said official, and in the following approximate quantities: Seven thousand feet of single-conductor varnished cloth insulated, lead-covered armored cable. Proposals must be made out upon blanks furnished by the Commissioner. William G. Keith, Commissioner of Gas and Electricity.

Financial Notes

Stockholders of the New England Company Power System have received their annual report for 1916. The past year's growth of $578,000 in gross above that of 1915, brings gross earnings for 1916 up to $2,068,000, and $711,000 net earnings on the shares, compared with $441,000 in 1915.

The Eastern Wisconsin Electric Company, owner of the Fond du Lac street railway and lighting system, and the Fond du Lac-Oshkosh interurban line, has filed a trust deed to the Wisconsin Trust Company, to secure an issue of $20,000,000 gold bonds, which are to run for 30 years, and to draw interest at 5 per cent.

The New Brunswick Power Company has recently been chartered to take over the St. Johns Railway Company, which operates the electric light and power, the gas and the electric railway service in St. Johns, N. B. Bodell & Company, Providence, R. I., has bought a large block of the company's first preferred stock.

The Public Service Commission has issued an order authorizing the Bethlehem (N. H.) Electric Light Company to issue 500 shares of its capital stock, amounting at par to $50,000, for the purpose of retiring $8,000 of its outstanding bonds, and for the payment of $42,000 of floating indebtedness incurred for plant extensions.

The outstanding common stock of the three subsidiaries of the Tri-City Railway & Light Company will be increased to cover the recent expenditures made on the properties. The Tri-City Railway Company of Illinois will issue $300,000, making its outstanding capital stock $3,300,000; the Peoples Power Company will issue $275,000, making its capital stock $3,275,000, and the Moline, Rock Island & Eastern Traction Company will issue $20,000, making its capital stock $195,000.

California Railway & Power Company has called a special meeting of stockholders for March 29, in New York City, for the purpose of taking action in regard to the proposed plan of reorganization of United Railroads of San Francisco, which involve among other things the disposition by California Railway & Power of the securities held by it of United Railroads, in-

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. Rate Per cent	Bid Mar. 12	Bid Mar. 19
Adirondack Electric Power of Glens Falls, common	....	24	24
Adirondack Electric Power of Glens Falls, preferred	6	80	80
American Gas & Electric of New York, common	10+extra	135	135
American Gas & Electric of New York, preferred	6	51	51
American Light & Traction of New York, common	....	355	355
American Light & Traction of New York, preferred	6	111	111
American Power & Light of New York, common	4	84	84
American Power & Light of New York, preferred	6	91	91
American Public Utilities of Grand Rapids, common	....	35	35
American Public Utilities of Grand Rapids, preferred	6	71	71
American Telephone & Telegraph of New York	....	127¼	127¼
American Water Works & Elec. of New York, common	....	11½	13
American Water Works & Elec. of New York, particip	7	27	35
American Water Works & Elec. of New York, first preferred	....	72	85
Apallachian Power of Bluefield, common	....	6	6
Appalachian Power of Bluefield, preferred	7	37	37
Cities Service of New York, common	6+extra	296	292
Cities Service of New York, preferred	6	90½	89
Commonwealth Edison of Chicago	8	134½	134½
Comm. Power, Railway & Light of Jackson, common	4	57	57
Comm. Power, Railway & Light of Jackson, preferred	6	80	80
Federal Light & Traction of New York, common	....	14	14
Federal Light & Traction of New York, preferred	....	51	51
Illinois Northern Utilities of Dixon	6	81	81
Middle West Utilities of Chicago, common	2+2 extra	58½	58
Middle West Utilities of Chicago, preferred	6	78	78
Northern States Power of Chicago, common	7	100	100
Northern States Power of Chicago, preferred	7	99	99
Pacific Gas & Electric of San Francisco, common	5	64¾	64¾
Pacific Gas & Electric of San Francisco, preferred	6	93	93
Public Service of Northern Illinois, Chicago, common	7	107½	109
Public Service of Northern Illinois, Chicago, preferred	6	99	100
Republic Railway & Light of Youngstown, common	4	41¾	40
Republic Railway & Light of Youngstown, preferred	6	72½	72½
Standard Gas & Electric of Chicago, common	....	13	13
Standard Gas & Electric of Chicago, preferred	6	39½	39½
Tennessee Railway, Light & Power of Chattanooga, common	....	7½	8
Tennessee Railway, Light & Power of Chattanooga, preferred	6	35	38
United Light & Railways of Grand Rapids, common	4	49	47
United Light & Railways of Grand Rapids, preferred	6	77	76
Western Power of San Francisco, common	....	17	17
Western Power of San Francisco, preferred	6	65	65
Western Union Telegraph of New York	5+extra	94⅞	94⅞
Industrials—			
Electric Storage Battery of Philadelphia, common	4	65	65
General Electric of Schenectady	8	164	164
National Carbon of Cleveland, common	8	†300	†300
National Carbon of Cleveland, preferred	7	†132	†132
Westinghouse Electric & Mfg. of Pittsburgh, common	5+extra	50⅞	50⅞
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	†69	†69

† Last Sale.

cluding stock of the San Francisco Electric Railways and the receipt of securities in such reorganization and for consideration of any other matters having to do with the proposed reorganization.

Quarterly dividend checks are being sent out by the American Light & Traction Company, New York, N. Y., together with a statement which shows gross earnings of $5,859,937 for the last year, an increase of $681,550 as compared with the previous year, and net earnings of $5,648,026, an increase of $626,263. The report says: "The increases in the company's earnings due to increased business are to some extent neutralized by constantly increasing federal taxes. In 1912 such taxes actually paid amounted to $3,004.50. In 1916 such payments totalled $79,692.93, an increase of $76,688.33 or 2,552 per cent."

The annual report of the Western Electric Company for the 12 months ending December 31, 1916, has been issued, and shows a remarkable increase in gross sales. They jumped last year from $63,852,469 to $106,986,677, a gain of 62 per cent. The orders on hand December 31, 1916, were $22,028,000 in value more than on December 31, 1915. The report states that manufacturing conditions in this country during the year have been extremely difficult. It has been almost impossible to provide a regular supply of material, not only on account of the general shortage, but also on account of the uncertainties of freight transportation. The demand for products increased very rapidly during the year, and the necessity of meeting this demand has taxed all available resources for machinery, tools and other expense items. The detailed earnings report for the year 1916 is as follows:

Sales	$106,986,677
Other income	1,229,636
Total income	108,216,313
Cost of merchandise	95,936,433
Expenses	7,014,254
Taxes	587,050
Special payments to employees	973,866
Reserve for contingencies	500,000
Available for interest and div.	3,204,710
Interest paid	880,094
Dividends	2,100,000
Carried to common stock	224,616

Incorporations

ALBANY, N. Y.—The Detroit Edison Company has filed notice of capital increase from $25,000,000 to $35,000,000.

PORTLAND, ME.—Peerless Light Co. Lighting fixtures, and lighting and mechanical engineers. Capital, $500,000.

MEMPHIS, TENN.—William Slater Electrical Company. Capital, $10,000. Incorporators. William Slater, Y. Slater, K. S. Cooper, T. H. Jackson and J. L. McRee.

PHOENIX, ARIZ. — Bertram Electric Company. Capital, $50,000. Incorporators: S. P. DeMund and F. C. Hoeppner, both of Phoenix.

TULSA, OKLA.—The Brent Electric Company. Capital, $10,000. Incorporators: W. A. Brent, T. C. Lichty and D. L. Thomas.

CHAMPAIGN, ILL.—Caldwell Electric Corporation. Capital, $25,000. Incorporators: C. M. Caldwell, B. J. Caldwell and E. C. Caldwell.

CHICAGO, ILL.—Mechanical Electric Service Company. Capital, $1,000. Incorporators: A. A. Rolf, Alvin E. Stein and George E. Peterson.

NASHVILLE, TENN.—Electrical Equipment Company. Capital, $10,000. Incorporated by Grayson Jones, J. T. Shannon, J. H. Conn and others.

HOBOKEN, N. J.—Cosgrove-Cook Company, 53 Newark Street. Capital, $50,000. Electrical engineers and contractors. Incorporators: Charles F. Cosgrove, Edward Cook and George A. Enright.

SCRANTON, PA.—The Scranton Electric Specialty Company. Nominal capital. To manufacture electric specialties. R. H. Dean, Scranton, principal incorporator.

MANCHESTER, KY.—The Manchester Electric Light & Power Company. Capital, $5,000. Incorporators: T. H. Webb, J. B. Wall, Lula Webb and Evelyn Webb.

LOUISVILLE, KY.—William C. Krauth Electric Company. Electrical contracting. Capital, $3,000. Incorporators: William C. Krauth, Edwin N. Krauth and H. F. Andres.

COLUMBUS, O.—The Buckeye Electric Sign Company. Capital, $10,000. Incorporators: Joe Jay Freeman, W. O. Daniels, C. E. Snyder, William F. Hess and Inez Freeman.

NEW YORK CITY.—American Balsa Corporation. Balsa wood and other insulating material. Capital, $275,000. Incorporators: A. P. Lundin, Queens, N. Y.; Samuel E. Miller and Jos. A. Bennett, New York City.

ATLANTA, TEX.—Gulf Public Service Company. Capital, $125,000. Incorporators: Edward S. Ellis of McAlester, Okla., J. S. Connerly of Port Arthur and O. C. Oden of Atlanta, Texas.

ROCHESTER, N Y.—The Curran-Swartout Company, Inc. Capital, $12,000. Electrical contracting. Incorporators: W. J. Swartout, O. D. and J. Curran, 191 Berkley Street, Rochester.

UTICA, N. Y.—Stiefvater Electric Company. Electrical work, etc. Capital, $15,000. Incorporators: Edw. G. Stiefvater, Albert C. Stiefvater and Chas. W. Clare, all of Utica, N. Y.

DOVER, DEL.—The Ohm Company. Capital, $10,000. To manufacture lighting fixtures of all kinds. Incorporators: V. C. Lindstrom, H. L. Dodson and C. M. Baumeister, Chicago, Ill.

NEW YORK CITY—Bonnell Electric Manufacturing Company. Electrical goods, etc. Capital, $50,000. Incorporators: Wm. A. Bonnell, H. F. Bonnell and Roderic Wellman, New York City.

DOVER, DEL.—Mardelva Electric & Engineering Company. Capital, $150,000. To install lighting plants. Incorporators: Daniel O. Hastings, Wilmington, Del.; James P. Bryan and Robert M. P. Kenton, Dover; L. LeRoy Gritzan, Baltimore, Md.; and Frank C. Bancroft, Camden, Del.

NEW YORK, N. Y.—The W. S. Barstow Management Association, Inc. Capital, $25,000. To manage public utility properties, including light, heat and power plants. Incorporators: W. S. Barstow, Great Neck, L. I.; J. B. Taylor, Allendale, N. J.; O. C. Swenson, 50 Pine Street, New York.

Electrical Patents Issued March 13, 1917

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,218,621. Slip-Coupling for Electric-Cable Conduits. M. Blumenthal, Brooklyn, N. Y. Structure of tubular device for producing continuous, smooth interior surface. (See cut.)

1,218,650. System for Amplifying Electrical Energy. R. V. L. Hartley, assignor to Western Electric Co., New York, N. Y. Plurality of thermionic repeaters working in cascade formation.

1,218,667. Motorcycle Transmission Mechanism. W. G. Johnson, assignor to Cleveland Motorcycle Mfg. Co., Cleveland, O. Structure of magneto drive.

1,218,682. Police Signaling System. L. W. Miller, assignor to National Police Signal Co., Buffalo, N. Y. Arrangement of emergency call in central and substation system.

1,218,692. Clock. C. E. O'Keenan, Paris, France. The primary actuator in a master-clock system in an electric converter governed by a clock escapement.

1,218,747. Multispeed Induction Motor. R. W. Davis, assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis. Detailed winding arrangements for varying the number of poles.

1,218,750. Automatic Gear-Shifting Mechanism. F. S. Denneen, Detroit, Mich. Operation of automobile gear shift by clutch-operating means electrically controlled.

1,218,766. Vehicle Lamp. E. A. Hawthorne, Bridgeport, Conn. Bracket for mounting lamp in universally adjustable relation to a support.

1,218,768. Thermostatic Regulator. W. C. Heindl, Rochester, N. Y. Thermostat electromagnetically controls connection of driving mechanism with furnace drafts.

1,218,772. Battery Depolarizer. M. E. Holmes, assignor to National Carbon Co., Cleveland, O. Manganous hydroxid is precipitated and then oxidized with chlorin.

1,218,795. Indicating and Recording Apparatus. B. F. Merritt, assignor to Western Electric Co. Details of structure operated by current impulses.

1,218,796. Signal Transmitter. B. F. Merritt, assignor to Western Electric Co. Details for spring-operated train of an impulse transmitter.

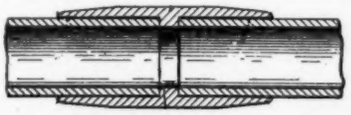
1,218,799. Phonograph Recorder and Reproducer. H. G. Pape, New York, N. Y. Structure of device having stylus carried by electromagnetically vibrated diaphragm.

1,218,802. Apparatus for Electroplating Pipes, Rods, Etc. N. H. Raymond, assignor to Clifton Mfg. Co., Jamaica Plain, Mass. Arrangement of tanks and supports.

1,218,804. Selective Signaling System. F. N. Reeves, assignor to Western Electric Co. For automatic party-line systems.

1,218,805. Automatic Call-Distributing System. J. G. Roberts, assignor to Western Electric Co. Call-recording system.

1,218,806. Telephone Trunking System. J. G. Roberts, assignor to Western Electric Co. Details of system wherein trunk line forms combined telephonic link and controlling circuit.



No. 1,218,621.—Slip-Coupling for Electric-Cable Conduits.

1,218,813. Sectional Post. S. M. Spencer, Eutaw, Ala. Combined metal and wood; for supporting live wires.

1,218,817. Apparatus for Producing Ozone. M. R. Tennant, Colorado Springs, Colo. Details of structure having a multiplicity of electric arcs causing a continuous flow of ultra-violet rays.

1,218,822. Driving Connection for Magnetos. L. W. Witry, assignor to Waterloo Gasoline Engine Co., Waterloo, Iowa. Special structure of frictional device.

1,218,847. Emergency Power Device. W. P. Firey, Roanoke, Va. In emergency, electrolyte is allowed to flow into battery cell having normally inert elements.

1,218,855. Light-Cutout Switch for Firehouses. J. Grouss, assignor one-half to C. E. Pryor, both of Elizabeth, N. J. Throwing in and out of operation of firehouse lighting system is electromagnetically controlled by lighting circuit.

1,218,864. Signal. W. R. Honeyball, Pasadena, Cal. Lamp is within transparent drum, rotation of which is electromagnetically controlled.

1,218,870. Duplexing Telegraphic Lines. I. Kitsee, assignor to American Telephone & Telegraph Co., New York, N. Y. Employs an auto-transformer.

1,218,890. Electric Switch. C. D. Platt, Bridgeport, Conn. Structure of two-push-button device.

1,218,892. Muffler for Telephones. A. Pludowski, Waterbury, Conn., assignor of one-third to W. Szczepaniak and one-third to S. Orlowski, Waterbury, Conn. Transmitter is mounted in a hollow, dome-shaped casing.

1,218,916. Method and Apparatus for Separating Magnetic Ores. J. Weatherby, assignor to Electric Ore Separator Co., New Cumberland, Pa. Magnetic and non-magnetic particles are agitated by subjecting to alternating magnetism and then stratified by subjection to constant magnetism.

1,218,934. Sound-Emitter. S. Evershed and W. D. Kilroy, Chiswick, England. Diaphragm is vibrated by a two-phase magnet.

1,218,935. Low-Water Alarm. C. R. Ford, Paducah, Ky. Alarm circuit controlled by indicator.

1,218,952. Rectifier for Polyphase Alternating Currents. E. Oelschlager, assignor to Siemens-Schuckertwerke, G. M. B. H., Berlin, Germany. Combination of a vapor rectifier and a phase transformer.

1,218,955. Service, Demand or Operation Recorder. E. G. Ralston, Indianapolis, Ind. Clock-controlled solenoid-operated stylus and record sheet.

1,218,960. Separating Device. M. Sleeth, assignor to Fort Pitt Bedding Co., Pittsburgh, Pa. Arrangement for magnetically separating iron and steel particles from a mixture on a conveyor.

1,218,965. Water Heater. J. K. Toles, San Francisco, Cal. Has an electric igniter for the fuel gas.

1,218,967. Separator for Storage Batteries and Process of Making the Same. T. A. Willard, Cleveland, O. Body of separator material has porosity-producing material embedded therein and exposed to the surface at intervals.

1,218,970. Device for Preventing Collisions Between Trains. A. R. Angus, Spit Road Mosman, New South Wales, Australia. Railway block-signaling system.

1,218,988. Two-Sheet Stop-Feed Detector Means. M. A. Droitcour, Delphos, O. Attempted feeding of two or more superposed sheets opens switch.

1,218,998. System for Packing and Shipping Telephone Apparatus. A. J. Haubrich, assignor to Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y. Casing and manner of securing apparatus therein.

1,219,001. Governor and Automatic Cut-Out for Electric Generators. S. F. Johnson and L. P. Ayres, Indianapolis, Ind. In a charging circuit for a storage battery, generator switch and driving connection are centrifugally controlled.

1,219,002. Electric Switch. S. F. Johnson and L. P. Ayres. Structure of reciprocating spring-contact device. (See cut.)

1,219,003. Binding-Post. W. Kaisling, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Details of structure having spring grip for conductor terminal.

1,219,008. System for Supplying Electricity. W. O. Kennington, assignor to Remy Electric Co., Anderson, Ind. Current and voltage control in generator and battery system for automobiles.

1,219,028. Land-Torpedo. A. Must, Ste. Agathe des Monts, Quebec, Canada. Four-wheeled truck carrying explosive is electrically driven and exploded through trailing wires.

1,219,053. Voting Apparatus. M. F. Thompson and A. L. Townsend, Washington, D. C. Townsend assignor to Thompson. Arrangement of operating circuits and signals controlled by voters' circuit-closers.

1,219,061. Mechanism for Automatically Controlling Elevator Cars. F. F. Worthen, Piermont, N. H. Structure of push-switch mechanism on car operated by cams on guides.

1,219,063. Electrical Piano. M. Arese, Turin, Italy. Manner of controlling key-operating magnets.

1,219,066. Headlight Dimmer. A. H. Babcock, Berkeley, Cal. Arrangement of reflectors.

1,219,074. Galvanic Battery-Cell of the Mercuric-Oxid Type. J. N. Bronsted, assignor to Firm of Hellesens Enke & V. Ludvigsen, Copenhagen, Denmark. Has mercuric oxid cathode, zinc anode and an aqueous solution of an alkali metal hydroxid of a certain concentration as electrolyte.

1,219,098. Trolley-Ear. W. F. Hall, Newton, Mass. Structure of straight-line trolley-ear.

1,219,108. Electric Self-Winding Clock. W. H. Kallenbach, Jamaica Plain, and C. C. Bertsch, Forest Hills, Mass. Uncoiling of clock main-spring actuates contacts controlling circuit of rewinding mechanism and clock is stopped if electric source fails.

1,219,109. Pocket Flashlight. M. L. Kaplan, assignor to Beacon Miniature Electric Co., Inc., New York, N. Y. Has clip for securing in pocket with which is associated switch preventing circuit closure when the device is in the pocket.

1,219,110. Method of and Means for Quadruplexing Cables. I. Kitsee, assignor to American Telephone & Telegraph Co., New York, N. Y. For quadruplexing lines of great capacity.

1,219,132. Meter-Testing Cutout. T. E. Murray, New York, N. Y. Special arrangement of contacts and plugs.

1,219,134. Switch. T. E. Murray, Jr., Brooklyn, N. Y. Details of device having fuse mounted on pivoted switch-lever.

1,219,135. Method of Flanging the End of a Metal Tube. T. E. Murray, New York, N. Y. Specially formed plate for flange is electrically welded to end of tube.

1,219,137. Electrical Welding Apparatus. T. E. Murray. For welding the end of a tube to a shoulder within a sleeve receiving the tube.

1,219, 137. Electrical Welding Apparatus. T. E. Murray. For welding tubes.

1,219,138. Electrically Welded Tube and Flange. T. E. Murray. Article produced by apparatus of No. 1.219,136.

1,219,139. Method of Electrically Welding the End of a Tube Within a Sleeve or Socket. T. E. Murray. Employed by apparatus of No. 1,219,137.

1,219,142. Electric Valve-Grinder. H. C. Newman, Los Angeles, Cal., assignor of one-half to L. O. Clampitt, Los Angeles, Cal. Mounting and gearing of electric driving motor.

1,219,143. Supervisory System. J. A. Noles, assignor to Automatic Fire Protection Co., New York, N. Y. For fluid-pressure conditions in fire-protective systems.

1,219,171. Chandelier. M. D. Schwartz, New York, N. Y. Ceiling fixture for indirect lighting systems.

1,219,189. Automatic Recording Fire-Alarm. H. Symes, Morington, New Zealand. Electrically controlled shutter controls automatically reset means for operating signal, etc.

1,219,190. Variable-Resistance, Electromagnetic, Drilling Machinery. H. Symes. Arrangement of magnets for drawing electrically driven drill against work.

1,219,194. Electric Zinc-Distilling Furnace. J. Thomson and F. A. J. Fitz Gerald, assignors to J. Thompson Press Co., Jersey City, N. J. Structure of apparatus having a suspended resistor facing a volatilizable bath.

1,219,215 and 1,219,216. System of Space Signalling. J. C. Armor, assignor to General Electric Co., Schenectady, N. Y. Alternating current of radio frequency is varied by subjecting to magnetic field of pulsating uni-directional current, the arrangement being such as to prevent induction of currents of radio frequency in the pulsating current circuit.

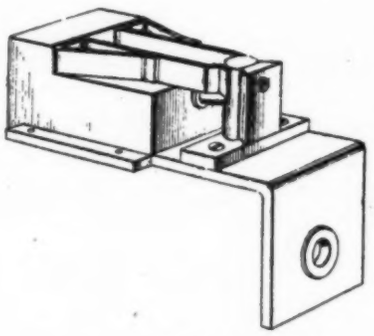
1,219,218. Illuminated Sign. E. P. Baker, Darien, Conn. Structure of lamp-enclosing casing.

1,219,228. Electrical Grounding-Clamp. J. E. Birdsall, assignor to William Gibson, Philadelphia, Pa. Conductor encircling band has solder which establishes connection on fusing.

1,219,230. Electric Route-Indicating and Lighting System. A. Blackmore, Kensington, London, England. For indicating the route to be followed in reaching any place; arrangement of lamps, circuits and selector switches.

1,219,236. License-Sign for Automobiles. H. Brewster, New York, N. Y. Structure of lamp box, etc., of a license-plate holder.

1,219,245. Speedometer. A. A. Canton, New York, N. Y., assignor to The Device



No. 1,219,002.—Electric Switch.

Testing Co. Indicator operated by solenoids movable with relation to a permanent magnet in response to difference in their strengths which varies with the speed.

1,219,247. Attachment for Motor Vehicles. H. B. Carmichael, Kegomic, Petoskey, Mich. Structure of switch box and mounting thereof and cable on steering column.

1,219,250. Lock-Case-Reversing Mechanism. R. Cecchini, West Springfield, Mass. Closing of special combination of switches necessary to operate driving motor in one direction or the other.

1,219,264. Gauge. H. L. Dawson, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Special form of liquid gauge has float controlling motor circuits.

1,219,265. Electric Fluid-Heater. H. W. Denhard, assignor to Cutler-Hammer Mfg. Co. Casing contains electrodes and adjustment is provided for fluids of different specific resistance.

1,219,300. Spark-Coil. J. A. Hall, assignor to Western Electric Co. Structure of casing and vibrator unit.

1,219,325. Winding Device for Spring-Motors. J. W. Jones, assignor to Jones Motrola, Inc., New York, N. Y. Circuit of electric driving motor is controlled by resistance of spring being wound.

1,219,333. Water-Purifying Apparatus. J. D. Kynaston, Washington, D. C. Water is given a gyratory movement in contact with electrodes.

1,219,338. Process of Treating Iron Ores. T. S. Maffitt, assignor to Mississippi Valley Iron Co., Wilmington, Del. Ore and gangue is heated to render its iron component magnetic and the iron is magnetically separated while in the heated state.

1,219,334. Push-Button Operator. I. Neckerman, Annapolis, Md. Lever mechanism for attachment to an automobile steering post.

1,219,394. Safety Headlight. R. G. Harris, assignor of one-fourth to F. Haynes, one-fourth to F. Hambright and one-fourth to J. T. Lewis, all of Knoxville, Tenn. Arrangement of bull's-eyes, protector tubes and reflector.

1,219,411. Hearing Aid. C. E. Williams, Chicago, Ill., assignor to Williams Articulator Co. Arrangement of portable telephone receiver and transmitter in conjunction with a high voltage battery.

Reissue 14,270. Centrifugally Regulated Power Transmission System. W. Morrison, assignor to Vesta Accumulator Co., Chicago, Ill. Variable speed driving shaft and driven shaft are connected by a dynamo electric generating clutch, the commutator being on one shaft and current collector on the other, and the collector is pressed on the commutor by centrifugal action to frictionally aid the clutching effect for preventing increased slip at high speeds.

Reissue 14,271. Dynamoelectric Clutch. W. Morrison, assignor to Vesta Accumulator Co. Structure of clutch in above.

PATENTS EXPIRED.

The following United States electrical patents expired on March 20, 1917:

645,547. Dry Galvanic Element. W. Botz, Ludwigshafen, Germany.

645,552. Combined Sleeper and Conduit for Electric Railways. W. Courtenay, New York, N. Y.

645,553. Mine-Haulage Locomotive. C. E. Davis, Chicago, Ill.

645,570. Telephone Appliance. C. E. Scribner, Chicago, Ill.

645,571. Telephone-Exchange Apparatus. C. E. Scribner.

645,572. Automatic-Calling Appliance for Telephone Trunk Lines. C. E. Scribner.

645,573. Electric Mine Bell. Barry Searle, Montrose, Pa.

645,576. System of Transmission of Electrical Energy. N. Tesla, New York, N. Y.

645,588. Fire-Alarm System. A. F. Doddridge, Chicago, Ill.

645,599. Automatic Fire Alarm. C. Law, Pittsburgh, Pa.

645,603. Device for Locating Grounds on Electric Circuits. M. J. Myers, Syracuse, N. Y.

645,612. Method of Distributing Energy. G. Westinghouse, Pittsburgh, Pa.

645,613. Apparatus for Distributing Energy. G. Westinghouse.

645,615. Electric Insulation for Railways. J. E. Wright, Omaha, Neb.

645,640. Storage-Battery Cell. R. N. Chamberlain, Depew, N. Y.

645,641. Illuminated Sign. G. J. Ferguson, Olyphant, Pa.

645,646. Electric Railway. E. C. Morgan, Chicago, Ill.

645,647. Third or Traction Rail for Electric Railways. E. C. Morgan.

645,648. Electric Railway. E. C. Morgan.

645,654. Third Rail for Electric Railways. W. A. P. Willard, Jr., Hull, Mass.

645,671. Electric Meter. E. W. Rice, Jr., Schenectady, N. Y.

645,674. Regulation of Dynamo-Electric Machines. C. P. Steinmetz, Schenectady, N. Y.

645,675. High-Potential Apparatus. E. Thompson, Swampscott, Mass.

645,684. Electrically Operated Switch. E. M. Hewlett, Schenectady, N. Y.

645,690. Section Insulator and Switch Therefor. G. R. Mair, Schenectady, N. Y.

645,736. Low-Water Alarm. W. D. McLauchlin, Corunna, Mich.

645,750. Storage Battery. P. Kennedy, New York, N. Y.

645,764. Train-Controlling Apparatus for Electric Cars. A. Sundh, Yonkers, N. Y.

645,765. Controlling Apparatus for Electric Cars. A. Sundh, Yonkers, N. Y.

645,766. Controlling Device for Mechanical Apparatus. A. Sundh.

645,767. Controller for Electric Railway Cars. A. Sundh.

645,774. Continuous-Current Transformer. A. Wydts and G. Weissmann, Paris, France.

645,784. Electric Arc Lamp. E. L. Bowen, McComb City, Miss.

645,785. Holder for Electroplating. W. Y. Buck, Bristol, Conn.

645,786. Art of Electroplating. W. Y. Buck.

645,809. Controlling Device for Electric Switches. E. W. Hammer, Chicago, Ill.

645,839. Signal for Railways. C. A. Stimpson, Philadelphia, Pa.

645,848. Electric-Light Hanger. D. Brown, Vancouver, Canada.

645,903. Motor-Vehicle Brake. E. A. Sperry, Cleveland, O.

645,907. System of Electrical Transmission. F. Bedell, Ithaca, N. Y.

645,910. Process of Locating Metallic Minerals or Buried Treasures. F. H. Brown, Chicago, Ill.

645,917. Telephone-Call Register. W. Gray, Hartford, Conn.

645,920. Method of Reproducing Phonograph Records. T. B. Lambert, Chicago, Ill.